National Institute for Fisheries Research (INRH)
Department of Marine Fishery (DPM)
Ministry of Agriculture and Marine Fishery (MAPM)
The Kingdom of Morocco

PREPARATORY SURVEY
ON
FISHERY RESEARCH VESSEL PROJECT
IN
THE KINGDOM OF MOROCCO

FINAL REPORT

MARCH 2013

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

OAFIC CO., LTD.

FISHING BOAT AND SYSTEM ENGINEERING ASSOCIATION

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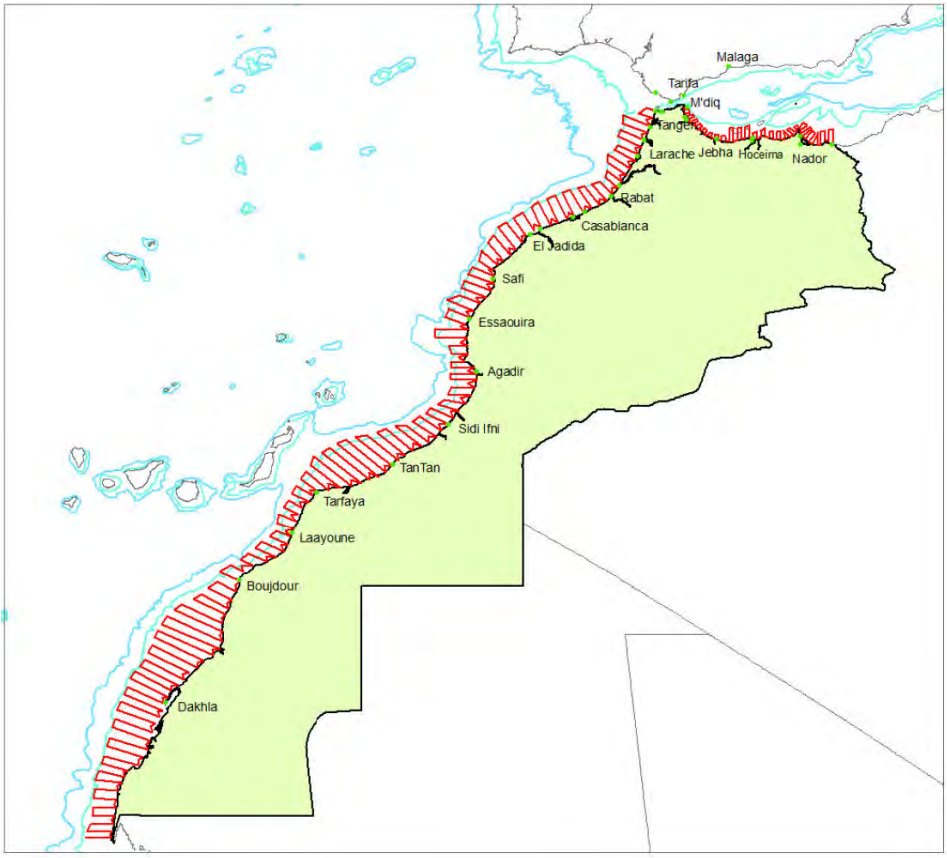
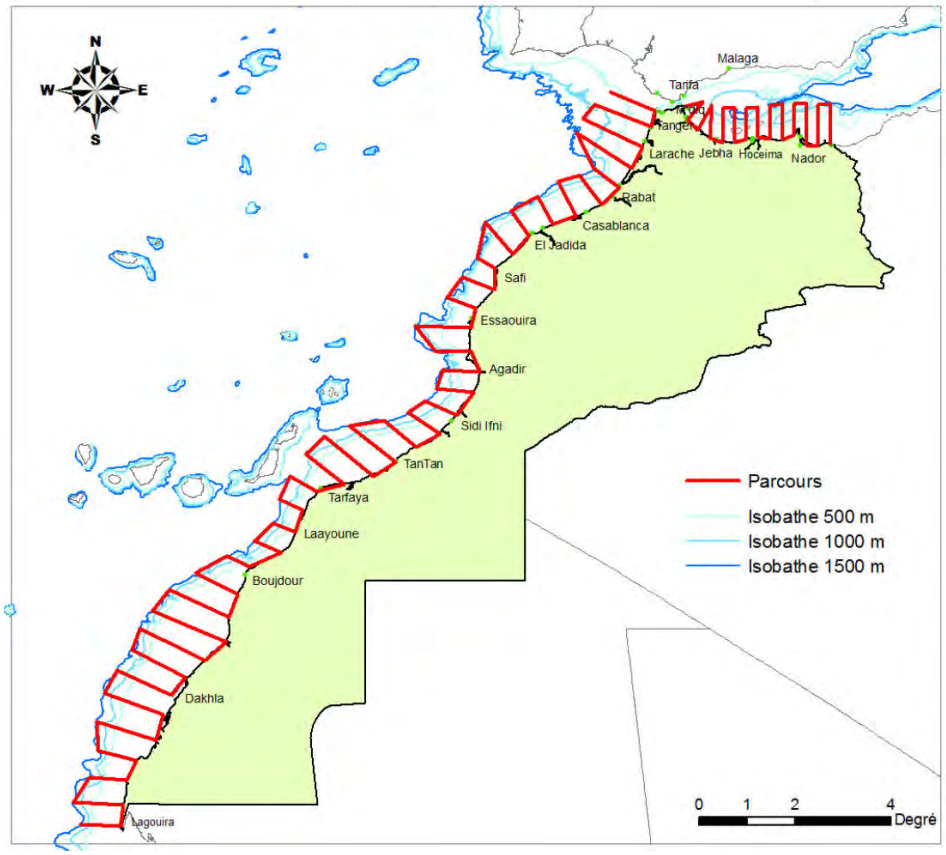
Anticipated Perspective

Image of a New Research Vessel (Plan A, Front-view)

Image of a New Research Vessel (Plan A, Aft-view)



Transects of ecosystem survey and pelagic fishery resources survey in autumn



Transects of ecosystem survey and demersal fishery resources survey in spring

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ABBREVIATION

ADCP	Acoustic Doppler Current Profiler
AMA	R/V Al Amir Moulay Abdarrah
ANP	Agence Nationale de Ports (National Ports Agency)
APP	Agence du Partenariat pour le Progrès (Progress Partnership Agency)
BF	Beaufort scale
CAI	R/V Charif Al Idrissi
CCLME	Canary Current Large Marine Ecosystem
CECAF	Commission for East-Central Atlantic Fisheries
CFC	Common Fund for Commodities
CPM	Chambre de Pêche Maritime (Chamber of Marine Fishery)
CPUE	Catch per unit effort
CTD	Conductivity-Temperature-Depth Profiler
CUFES	Continuous Underway Fish Egg Sampler
D/D	Detailed Design
DH	Dirham
DIP	Direction de la Pêche Industrielle (Direction of Industrial Fishery)
DO	Dissolved Oxygen
DPM	Département de la Pêche Maritime (Department of Marine Fishery)
DPMA	Direction de la Pêche Maritime et de l'Aquaculture (Direction of Marine Fishery and Aquaculture)
EIRR	Economic Internal Rate of Return
E/N	Exchange of Notes
EU	European Union
FAO	Food and Agriculture Organization
FTA	Free Trade Agreement
ICB	International Competitive Bidding
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea
ILO	International Labor Organization
IMF	International Monetary Fund
IMO	International Maritime Organization
INRH	Institut National de Recherche Halieutique (National Institute for Fisheries Research)
UNESCO-IOC	UNESCO Intergovernmental Oceanographic Commission

IOCCP	International Ocean Carbon Coordination Project
ISEM	Institut Supérieur d'Etudes Maritimes (Superior Institute of Maritime Studies)
ISPM	Institut Supérieur des Pêches Maritimes (Superior Institute of Marine Fisheries)
ITPM	Institut de Technologie des Pêches Maritimes (Marine Fisheries Technical Institute)
ITQ	Individual Transferrable Quarter
L/A	Loan Agreement
LR	Lloyd's Register
MAPM	Ministère de l'Agriculture et de la Pêche Maritime (Ministry of Agriculture and Marine Fishery)
MCC	Millemium Challenge Corporation
MEE	Ministère de l'Eau et de l'Environnement (Ministry of Water and Environment)
MEF	Ministère de l'Economie et des Finances (Ministry of Economy and Finance)
MLC	Maritime Labor Convention
NK	Nippon Kaiji Kyokai
OJT	On-the-Job Training
ONP	Office National des Pêches (National Fisheries Office)
PMP	Preventive Maintenance Policy
PQ	Pre-Qualification
R/V, N/R	Research Vessel / Navire Recherche
SG	Sécretaire Général (Secretary General)
SPS	Special Purpose Ship
STCW	Standards of Training, Certification and Watch-keeping for Seafarers
STEP	Special Terms for Economic Partnership
TAC	Total Allowable Catch
T/A	Technical Assistance

Summary

1. Background and needs for the Project

The fishery sector of the Kingdom of Morocco represents only 3.1 % of the GDP in 2010 (about 636.57 billions of dirhams), from which the amount of fishery production is 6.65 billions of dirham (about 63.9 billion yens) and the amount of export of seafood is 12.97 billions of dirham (about 124.6 billion yens), but constitutes a priority sector, from the point of view of its significant contribution as a source of income generation of coastal fishermen (about 108,000 direct jobs), a source of provisions in animal proteins (consumption by capita per year estimated from 10 to 12 kg), as well as source of foreign currencies earnings (share of seafood: 5 to 6 % of total exports value, 45 to 50 % of the total food exports in value).

Morocco, located at the northwest extreme side of the African continent, and formed of highly productive fishing grounds in its Atlantic coast in particular, thanks to the influence of the cold Canary Current and several outbreaks of upwellings. Benefiting from this reosource richness, the fisheries sector, which knew public investments in port facilities, and private investment in fisheries fleets and processing units among others, contributes in a significant way to national economy and to promotion of exports. However, for structural reasons, this sector does not currently take enough advantage of its strong development's potential, which results in stagnation of the fishery production volume, and an inactivity in terms of optimization and efficient use of fisheries resource. Considering such situation, the Ministry of Agriculture and Marine Fisheries (MAPM) of Morocco developed "Plan Halieutis" (Target year: 2020), whose objective is to establish a sustainable and competitive fishery sector that is contributing to the promotion of fisheries resource and to the State's economic growth. "Plan Halieutis" set one of the numerical objectives consisting of increasing the percentage of captured species under quota (report expressed in catch volume) to 95 % by 2020. To achieve this objective and follow a sustainable management of resources, the accurate and larger survey data will be necessary, mainly, data based on the ecosystem approach taking into account the environmental factors and the inter-relation among fish species. Moreover, on the basis of the aforementioned Plan Halieutis, the National Institute for Fisheries Research (INRH) developed its three-year plan « Strategic Development Plan » (2011-2013) to reinforce the capacities of oceanographic research and resources survey. The construction of the new research vessel (the 3rd vessel of INRH) is considered essential for achieving "Plan Halieutis" and the «Strategic Development Plan» (2011-2013) of INRH.

2. Actual situation and issues of fisheries resource survey

Studies of fisheries resources in Morocco are conducted at the initiative of the Department of Fisheries Resources of INRH through 2 existing research vessels, that are " R/V Charif Al Idrissi (CAI) " and « R/V Al Amir Moulay Abdallah (AMA) » belonging to INRH, by survey area, 2 to 3 times per year for demersal fish (max. 5 times), twice a year (spring and autumn) for small pelagic fish. The number of days at sea during 2011 reached 173 days for R/V "AMA" and 168 days for R/V "CAI" respectively, which represents in general a high exploitation rate. Nevertheless, there are problems concerning size and capacities of the research vessels, which could stand as an obstacle to carry on research activities.

i) The existing research vessels are carrying out to the maximum the acoustic survey of pelagic species and monitoring survey of demersal species, however, that all they do; they are not satisfactorily able to follow oceanographic or biological surveys by sampling. Under these conditions, it would be difficult to build an evaluation system of resources with maximum accuracy (stock assessment based on ecosystem approach).

ii) In spite of the existence of profitable resources as the prawn in the zones between 800 m and 1,500 m depth, since the features of the existent research vessels allow only studying

the zone with depth up to 800 m (1,000 m maximum), it is actually impossible to collect all data necessary to understand the situation of deep see resources.

iii) R/V "CAI" should be put out of service because of obsolescence in 2020, and the R/V "AMA" in 2030. It is therefore expected that the survey functions of research vessel fall more than in the present state.

To overcome these challenges, the acquisition of the new research vessel is necessary.

3. Appropriate contents, scale and scope of the Project

The new research vessel should be equipped with functions allowing to undertake, besides stock assessment conducted till now by the 2 existing research vessels (R/V "CAI" and R/V "AMA"), ecosystematic study (up 1,500 m of depth) conducted up to now by the foreign vessels (Norway, Spain, Russia, etc) in the Moroccan exclusive economic zone. ((i) Atlantic coast which is affected by the current of Canary Islands and "Upwelling" and (ii) Mediterranean coast which is characterized by the impact of current passing through the Straits of Gibraltar and the sharp slope of sea bottom).

The following table summarizes the distribution of roles between the existing vessels and the new vessel after being implemented.

	Autumn	Spring
New R/V	Day: Pelagic resource survey (range of measurement lines: 10 000, depth: up to 1 000m) Night: Ecosystem survey (range of measurement lines: 30 miles, 5 points per line)	Day: Demersal resource survey (survey grid: 10 miles, depth: up to 1,500m) Night: Ecosystem survey (range of measurement lines: 30 miles, 5 points per line)
Existing R/V (R/V "AMA")	Day: Demersal resource survey (depth: up to 200m, survey grid: 10 miles) (depth: 200 – 800m, with "Al Hassani")	Day: Pelagic resource survey (distance of transects: 10 miles, depth up to 1,000m)
Existing R/V (R/V "CAI")	Day: Monitoring survey of demersal species (depth up to 800m, survey grid: 10 miles) (1st year for inter-calibration with R/V "AMA", 2nd year for inter-calibration with the new research vessel, the third year off service)	

The necessary conditions of the new research vessel are the following:

i) The required survey functions (possibility of exploring until 1,500 m of depth) will be almost satisfied;
ii) The minimum staff on board (20 crew and 15 scientists) will be able to be received;
iii) On the basis of the survey navigation plan, the endurance of at least 30 days shall be ensured;
iv) Considering the easiness of operation & maintenance, it should be necessary to avoid a large-sized hull;
v) The propulsion mode, considering the easiness of operation & maintenance, will be of diesel engine propulsion;
vi) The Vessel will be a stern-trawler type with double deck structure appropriate for survey works;
vii) Both pelagic trawl and bottom trawl will be independently equipped respectively.

By taking into account the size and contents of the new vessel, which satisfy conditions and requested capacities, 2 option plans indicated in the following table are proposed:

		Plan A (recommended)	Plan B (alternative)
Principals	Gross tonnage	About. 1,100G/T	About. 800G/T
	Length Over All (LOA)	About. 60.40m	About 49.99m
	Width	About. 11.60m	About 10.40m
	Projected displacement at full load	About. 3.40m	About. 3.70m
	Main Engine	Diesel 1,838 kW (2,500 PS)	Diesel 1,437 kW (2,000 PS)
	Maximum autonomy	9,300 miles (at 12 knots)	7,800 miles (at 12 knots)
	Exploration autonomy	30 days (reserve fuel: 250m3) 45 days (freshwater reserves and food) With fish hold (12m3, -20 ℃)	30 days (reserve fuel: 210m3) 45 days (freshwater reserves and food) Without fish hold
	Staff number onboard	40 people (28 cabins) (20 crew and 20 scientists)	35 people (22 cabins) (20 crew and 15 scientists)
	Cruise speed	About 13 knots	Approx. 12.5knots
Survey area		Moroccan areas + neighboring countries areas	Moroccan areas
Survey depth	Pelagic survey	Area bounded by the curve isobath to 1,000 m	Same as left
	Bathymetric survey	Up to 1,500 m	Same as left
	Demersal survey	Up to 1,500 m	Up to 1,200m
	Oceanographic survey	Up to 1,500 m	Same as left
Onboard laboratories		4 laboratories, about 93 m² in total	4 laboratories, about 70 m² in total
Vessel Stability (BF7, significant wave height: 4m at the research stoppage)		Roll angle of about 10 ° (5 ° with anti-roll tank in action)	Roll angle of approximately 13 ° (without anti-roll tank)
No. of days possible to do survey		347 days / year (capable to do survey up to BF7)	312 days / year (capable to do survey up to BF6)

4. Plan and schedule of Project implementation

The objective of the Project is to strengthen scientific research capabilities on fisheries resource by constructing a new fishery research vessel in conformity with the Plan Halieutis of the Moroccan government, in order to contribute to sustainable management of fisheries resource and development of fishery sector in Morocco. The project consists of the construction works (construction of the Vessel including procurement of survey equipment and materials) and the consulting services.

A new vessel to be constructed within the framework of the Project will be in diesel propulsion by taking into account maintenance and costs. While many Japanese fisheries research vessels are all in diesel propulsion, most of those constructed since 1995 in the western countries have chosen the electrical propulsion mode.

Electrical propulsion has advantage certainly to control and reduce underwater noise, but its propelling output is lower than that of diesel propulsion, which results in a higher cost of construction and maintenance. On the other hand, the Moroccan crew members are adapted to diesel propulsion mode.

The fisheries research vessels constructed in Europe or in Japan are equipped with survey equipments such as the acoustic equipment manufactured by specific companies. Considering the possibility of undertaking joint studies between INRH and European and/or neighboring countries, data sharing and maintenance, it seems appropriate to plan to procure and equip specific foreign products through their agents and distributors in Japan.

The procurement will be done through the international competitive bidding (ICB). It seems indispensable from technical point of view for the bidding, the shipbuilders should have at least an

experience in construction of research vessels of similar size accomplished during the last 10 or 20 years. As a result, the Project will have recourse to pre-qualification (P/Q), with a view to proceed to the pre-selection of bidders who have technical capacities and the achievements of construction. On the other hand, the tendering packages will consist of two lots: i) construction and transport of the research vessel (including purchase and installation of the survey equipment, training of officers and crew of the research vessel), and ii) consulting services.

The expected period of the signature of the Loan Agreement up to the delivery of the Vessel to Morocco is 77 months in case of « General untied » project and about 70 months in case of STEP project.

5. Project cost

Total project cost (except VAT and import duty), the eligible amount for Yen loan, interest charges, and total amount of payment are estimated as shown in the following table.

(Unit: million Yen)

	Plan-A (1 100G/T)		Plan-B (800G/T)	
	STEP	General untied	STEP	General untied
Total project cost (A)	6,972	7,197	5,953	6,154
(Eligibale amount for Yen loan (B))	(6,582)	(6,646)	(5,620)	(5,685)
Interest charges (C)	158	769	134	648
Total amount of payment (A+C)	7,130	7,966	6,087	6,802
(Total amount of repayment (B+C))	(6,740)	(7,415)	(5,754)	(6,333)

(Note) Total project cost includes administration cost, interest during construction and commitment charge, as non-eligible portion for loan.

Total project cost of general untied project is about 200 – 220 million Yen higher than STEP project. Although the loan amounts are almost same between STEP and general untied, due to the difference in loan terms, the total amount of payment by the Moroccan side including the interest is about 710 – 850 million Yen higher in case of general untied than STEP. Thus, the STEP project is significantly advantageous.

6. Organizational system of the Project implementation

The following 2 options on the project implementation system were proposed by the Moroccan side. It is recognized that it is important for INRH to be the owner of the Vessel so as to operate and maintain the research vessel, while the borrower of loan will basically be the owner of the Vessel in case of loan project. Given the MEF is the borrower, the legal possiblilty that INRH can be the owner of the Vessel is under examination by the Moroccan side, so that it will be finally determined after the receipt of this Final Report.

	Proposal in the DF/R	Proposal by the Moroccan side	
		Option 1	Option 2
Borrower / Reimburser	MEF	INRH	MEF
Implementing agency	DPM	INRH	INRH / DPM
Operation & maintenance agency	INRH	INRH	INRH
Ownership of the Vessel	INRH	INRH	INRH

7. Organizational system of navigation, operation and maintenance of the Project

The number of days of navigation per year of the new vessel is estimated at 171 days (except stop and rest days, 24 hours of operation per day), that of R/V " AMA" at 148 days (15 hours of operation a day), that of "Al Hassani" (chartered vessel) at 44 days (15 hours of operation a day), and that of R/V " CAI" between 75 and 86 days (for calibration with the new research vessel and "AMA", 15 hours of operation a day). The number of days of navigation of these 3 vessels (excluding that of "CAI" which is scheduled to retire in 2020) is therefore estimated to 534 days per year in total

(that of the new vessel is doubled, because it will take the system of 24 hours of operation a day). In addition to ordinary navigation survey, the 3 vessels carrying out monitoring survey in the coastal artificial reefs areas or surveys entrusted by outside agencies, it will be possible to reach the target of INRH (« Strategic development plan (2011-2013) ») of 600 days of operation per year.

The necessary number of the crew for operation of the new research vessel is 20 persons (9 officers + 11 non-commissioned officers), to which 15 to 20 scientists are added. To ensure the number of crew members, a certain number of required licence holders have to be either transferred from the existent vessels, or newly hired (new hiring, at least, of a 1st class chief engineer and some graduated from ISPM as a non-commissioned officer).

The annual cost of operation and maintenance of the new research vessel is calculated, on average of 25 years, at about 21.7 million DH / year in case of Plan A, and at 18.3 million DH in case of Plan B.

Moreover, the annual cost of operation and maintenance of the existing research vessels is estimated at 13 to 14 million DH / year for R/V " AMA" (including operation cost for the chartered vessel "Al Hassani"), and at 10 to 12 million DH / year for R/V "CAI". As a result, during the first 2 years, which follow the commissioning of the new vessel, it seems necessary to expect a considerable increase of the budget for navigation and maintenance, that is from 39.0 to 41.6 million DH for the 1st year. It should be noted, however; that as soon as R/V " CAI" retires in 2020, this cost would be of 31.2 to 34.7 million DH on a yearly average. While the actual cost of operation and maintenance is 20 million DH per year, it will be possible to increase the budget for these costs by taking into account the following situations:

i) "Plan Halieutis" emphasizes on the importance of survey and research in fisheries resource in particular;
ii) Amount of the government subsidy was increased in accordance with new investments in capital goods;
iii) Morocco aims to improve the GDP of science and technology sector from actual 0.2 % to 2 %.

On the other hand, for efficient operation and maintenance of the new vessel, the establishment of a Technical Assistance attaching to the Project, which will focus on the maneuver of the vessel, handling of the equipment, as well as the transfer of technology related to the maintenance of the vessel's hull and of its equipment, is expected. The period of Assistance will be 3 years (consisting of 1 year of construction phase and 2 years of the operation phase).

8. Effects of the Project

It is assumed that the survey data acquired through the stock assessment and marine ecosystem survey that are to be used for the following purposes:

i) Scientific support for the development of fisheries resource management plan (collaboration with MAPM);
ii) Preservation of marine environments and biodiversity (co-research with universities and/or Ministry of Environment);
iii) Provision of information to the fishers / aquaculture farmers.

The economic benefits by acquisition of the new research vessel are assumed as follows:

i) Thanks to the achievement of assessment and resource management based on ecosystem approach, actual fishery and aquaculture resources would be sustainably put into operation, so that the volume of catches is stabilized;

ii) The survey on deep sea fisheries resource (depth from 800 to 1,500 m) would be performed, so as to allow the development of unexploited resources;
iii) The stabilization of catch volume would stably allow sourcing raw materials for the processing and would maintain industrial activities of seafood processing;
iv) Information on fishing grounds and marine environments would be shared by the associations of fishermen, in order to enhance the catches productivity;
v) Thanks to obtaining the certification by ecological labels, the fact of being able to prevail worldwide that it is about seafood captured under relevant resources would cause an increase in the market value.

Regarding the benefits produced by the stabilization of catch volume, an approximate calculation showed, as stated in the table below, that in any scenario and plans, the EIRR would exceed 20 %, with higher value in case of STEP than the general untied project.

	Scenario 1		Scenario 2		Scenario 3	
	Plan A	Plan B	Plan A	Plan B	Plan A	Plan B
STEP	27.7%	30.0%	26.4%	28.7%	25.0%	27.5%
General untied	26.4%	28.5%	25.2%	27.3%	23.8%	26.0%

As we can expect different possibilities such as increasing the cost of management and maintenance due especially to the rising prices of fuel, and/or the reduction of fisheries production income due to failure of the resources management, the analysis of sensitivity was done in many cases. Consequently, even in the less favorable hypothesis (100% increase of fuel prices and benefits acquired only by octopus, squid/cuttlefish and shrimps), the EIRR is 15.9%, so that the Project is justified economically.

The social benefits expected by the commissioning of the new research vessel cover, among others, the following 5 effects:

i) Early detection and reduction of marine pollution;
ii) Increase of job opportunities for researchers;
iii) Increase of the number of Master and PhD students in environmental oceanography;
iv) Stable supply of the fishery products;
v) Contribution in regional and sub-regional cooperation.

The main seafood products in Morocco are sardines, octopus and shrimps. In case the Project would not be implemented, as the the existing research vessels are put out of service, the surveys of monitoring resources would become impossible for demersals from 2021, and for pelagic from 2031, so as not to deepen levels knowledge and evolution of existing stocks any more. This would make it impossible to develop any management action, such as the introduction of quotas, and would be likely resulted in overfishing, and in the worst case, by the risk of exhausting the fisheries resource.

Therefore, the depletion of one of the 3 species above seems to lead to a significant socio economic losses (negative impact) such as the reduction of fishery production incomes (560 - 1,330 millions of DH / year), reduction of foreign currencies earnings (98 - 374 million dollars / year), bankruptcy of seafood processing plants (7 - 65 plants), increase of abandoned fishing boats (59 - 577 boats) and increase of unemployment (1,400 - 51,000 unemployed persons)

9. Points to be considered to achieve the Project

In order to prevent marine pollution resulting from oils, wastewater and garbage as well as air pollution by the commissioning of the new research vessel, it is important to install the systems and

facilities so that no problem occurs to respect international standards (by ensuring that there is no sake to comply with international standards of the international convention for preventing of pollution by ships, known as MARPOL) as well as the respect of our planet's environment.

On the other hand, it is important to draw up the plan and to build the new vessel in accordance with the classification codes and convention and to submit it to inspection by competent authorities. Moreover, it is confirmed by the Moroccan government that it is not necessary to follow "MLC 2006" (International convention) and "SPS 2008" (International code) for the new research vessel. The procedure of acquisition of the flag, modification of classification and procedure of tax exemption are to follow.

10. Conclusion and Recommendation

We can say that the new fishery research vessel which will be acquired within the framework of the Project is consistent with national policy, including "Plan Halieutis" and contributes in accomplishing this policy, and the acquisition of the Vessel is considered relevant and necessary to the technical, social and economic plan. Regarding the option plans, given the fact that according to the difference of construction cost and operation & maintenance cost between Plan A and Plan B, the Plan A can be adapted to a large range of use, it is recommended to opt for Plan A in which the ship provides a better cost performance ratio over the long-term.

The recommendations for implementation of this Project are the following 3 points

i) Promotion of the implementation as STEP loan project

Considering the main characteristics and missions of the new vessel as well as the maintenance, the Moroccan side desires to construct the fishery research vessel which is 800 – 1,100 GT trawler type with double deck and a diesel engine propulsion. It is necessary to construct the Vessel satisfying the above conditions in a technically reliable shipyard having the experience in construction of this type of vessels. Compared the past 20 years experience in construction, this type of vessels had not been constructed in the most of countries except Japan. In this context, the Moroccan government desires that the Vessel would be constructed in the Japanese shipyard that excels technically, and it is also desirable to apply the STEP in terms of loan conditions.

ii) Insurance of the budget for the operation and maintenance costs

To allow further facilitating the commissioning operation and maintenance of these research vessels, it will be necessary to stably obtain the budget for operation and maintenance. In addition, it is desirable that INRH will create "Business unit" and "Maintenance funds" including capacity building of staff, as soon as possible.

iii) Necessary preparation for Technical Assistance

It is important to provide, since the construction phase of the vessel, developing the capacities of the Moroccan crew and scientists on board. It is desirable, before starting any Technical Assistance to the operation and maintenance of the vessel, to have qualified seamen to get onboard of the vessel.

Chapter 1 Background and need for the Project

1.1 Current situation and issues of the fishery sector

The fisheries sector in the Kingdom of Morocco (hereinafter referred to as "Morocco") represents only 2 to 3% of its Gross Domestic Product (GDP), but occupies a significant place in terms of contribution to the national economy, and that, in comparison with other sectors such as transport, telecommunications, textile and leather, hotel / restaurant, electricity / electronics and water services, mining, chemical industry, which do not also exceed 5% of GDP. The fisheries sector in Morocco represents only 3.1% of GDP in 2010 (about 636.57 billion dirhams), of which the amount of fish production is 6.65 billion dirhams (63.9 billion yen) and the value of exports of seafood is of 12.97 billion dirhams (about 124.6 billion yen), but constitutes a priority sector from the point of view of its significant contribution as follows:

i) Job creation
Direct jobs: approx. 170,000 fishermen (110,000 inshore fishermen 60,000 industrial fishers)
Indirect jobs: approx. 490,000 (processing and distribution)
In the southern region of the country in particular, more than 3 million people are concerned with fishing.

ii) Source of animal protein intake
Consumption of fish products per capita per year estimated to 10 to 12 kg, which represents approximately 30% of total animal protein intake. Sardines are particularly cheap and have a high content of protein.

iii) Source of foreign currencies earnings
Part of seafood: 5 to 6% of the total export value, 45 to 50% of total food exports in value, in addition, these amounts tend to increase.

While fisheries production increased from 950,000 tons in 2003 to 1,140,000 tons in 2010, and the majority of this increase was achieved by foreign fishing vessels (chartered fishing vessels) and offshore fisheries, but the volume of catch from coastal fisheries remains stable (see Figure 1-1). The increase of pelagic fish catches in 2009 and 2010 marked the peak in catch volume, but in 2011 the catch volume of sardines which occupied about 70% of the total catch has decreased significantly from 767 to 499 thousand tons (National Office of Fisheries, 2011). Because of the change of fish habitat area which seems to be caused by the influences of climate change such as global warming, the volume of catch of small pelagic represented by the sardine shows significant annual fluctuations and is in a precarious situation (see Figures 1-2 and 1-3). Moreover, the value of production marked the peak in 2008; the increase is remarkable compared to the increase in catches. This is explained by the fact that the catch of octopus which takes an important position in the value of production has almost increased this year compared to the previous year (Figure 1-3). On the other hand, then the production volume increased in both inshore than offshore, production has gone down. This appears to be attributable to an increase in the proportion of catches of small pelagic with lower unit price (Figures 1-2 and 1-3) on the one hand and on the other hand, a decrease in the value of production of octopus probably due to the shock of Lehman (Figures 1-4 and 1-5), and a stagnation of prices of cephalopods and crustaceans which are the main export products (Figures 1-6 and 1-7).

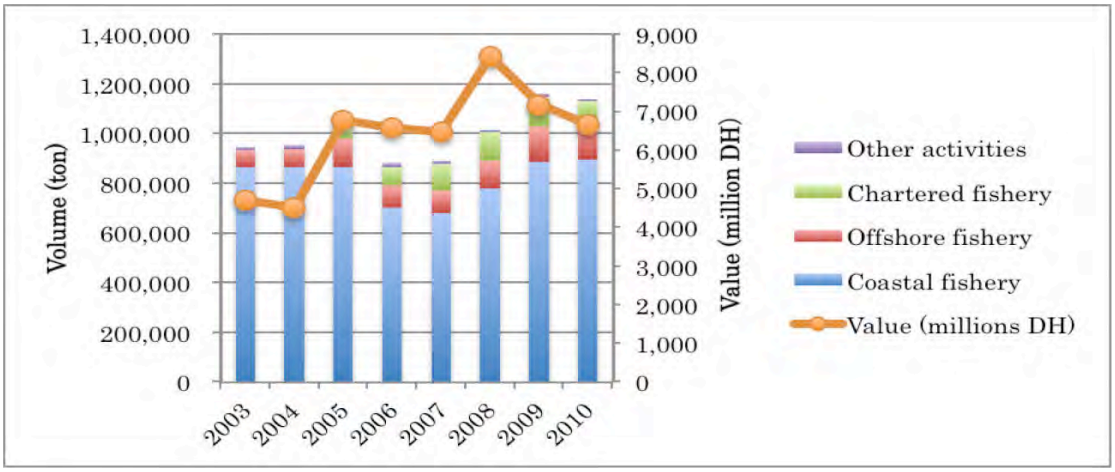


Figure 1-1: Evolution of fish production in Morocco in volume and value (primary sector)

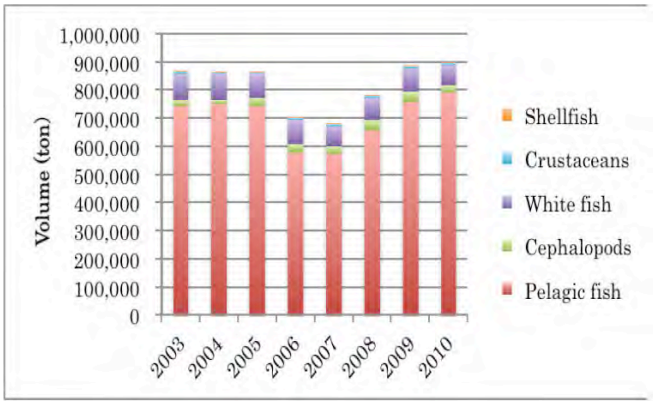


Figure 1-2: Coastal fishery production

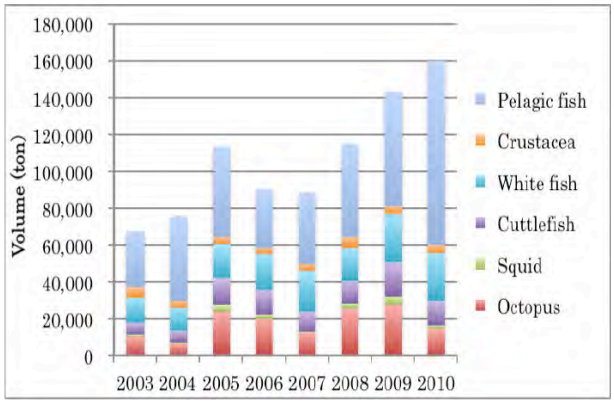


Figure 1-3: Demersal fishery production

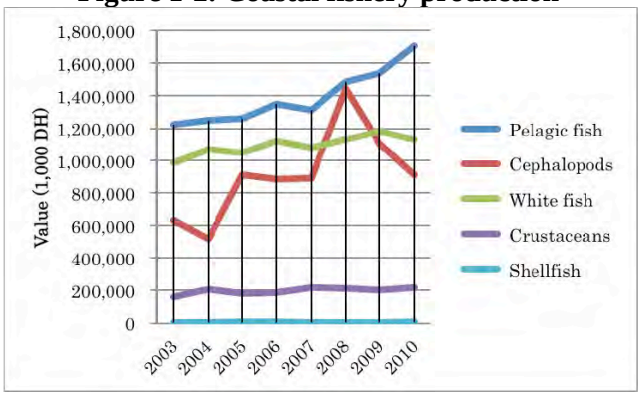


Figure 1-4: Composition of production value of coastal fisheries

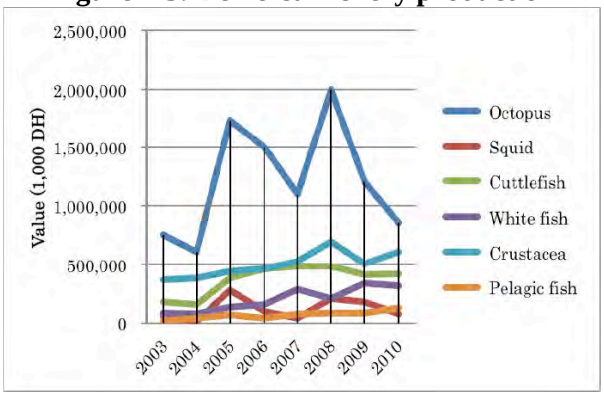


Figure 1-5: Composition of production value of offshore fisheries

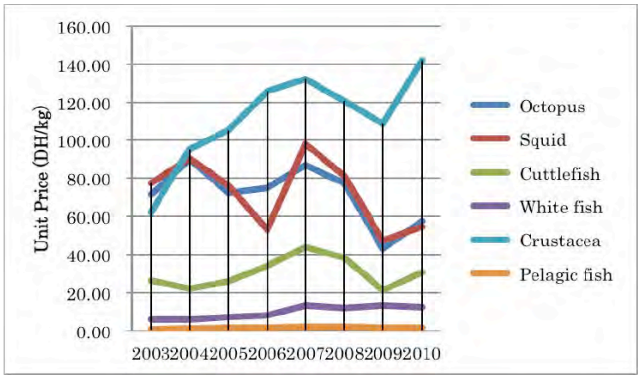


Figure 1-6: Unit price of coastal fisheries products

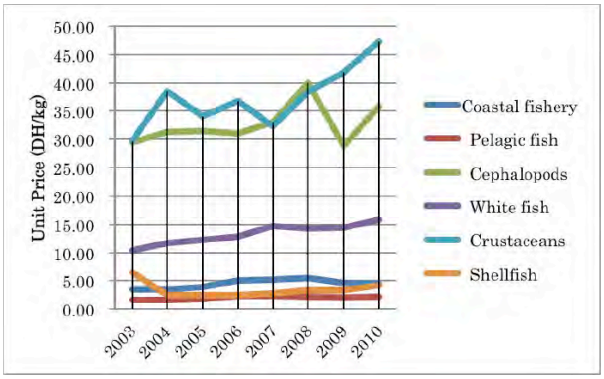


Figure 1-7: Unit price of offshore fisheries products

Source: Ministry of Agriculture and Maritime Fisheries

As noted above, since 2000, the fisheries sector in Morocco grew only in very low proportions on the level of production volume and value, which appears to be due to the following 8 causes (obstacles to development and blocking factors):

i) Insufficient organizational system of fisheries management: There is only very limited study data, insufficient to satisfactorily perform the management of these resources, we have seen an unbalanced exploitation of resources ;
ii) Limited use at certain stocks: pelagic fish represent 85% of the total catch, but occupy only a quarter of the total production;
iii) Inappropriate fishing effort: The fishing efforts are excessive in the northern coast of the country and inadequate in the south coast, compared to the value of production;
iv) Troubles in fishing ports: Ports fishing today suffer from dysfunctions related particularly to port congestion, obsolescence or inadequate facilities, and lack of managerial capabilities of organizations and the virtual absence of maintenance;
v) Structure of the sector is fragmented and compartmentalized: The predominance of small business of fishing and aquaculture in Morocco is disadvantageous at the level of competitiveness, which prevents also undertaking the development of new products whose importance is increasingly recognized;
vi) Distribution channels are unorganized and uncompetitive: Channels of distribution and marketing of seafood are still underdeveloped, and besides their work efficiency is still low compared to Asian countries;
vii) Legislative regulations, customs and health: Some laws and regulations currently becoming ineffective, especially regarding the effects of surveillance;
viii) Competitive international market: The global market requires increasingly adapting to international standards and norms, as well as certification systems.

On the other hand, the Moroccan fisheries sector offers 7 development opportunities described below:

i) Existence of abundant fish resources: With annual landing of 1 million tonnes, Morocco ranks first worldwide in the production of sardines ;
ii) Potential of aquaculture development: Coastal areas of Morocco have topography and water quality suitable for marine aquaculture;
iii) High adaptability to international standards: 92% of companies processing fish products are qualified to export to Europe and the United States, but do not benefit enough;
iv) Geographic proximity and preferential right: The Moroccan products are exempt from customs duties for import / export market of over a billion people, including the EU, the U.S., Turkey, Jordan, Egypt, and ;
v) Historical position in terms of specific products: the exportation of sardine processing products represents more than 40% of the international market, and has increased during the last 10 years (1997 to 2007) at a rate of 6% per year in average;
vi) Export markets with strong potential: Despite the overall trend of decreasing fish stocks, global consumption of fish products has increased over the past 10 years (1997 to 2007), in volume to 3% per year, and value to 5% per year;
vii) Potentially growing national demand: National consumption of fish products recorded an increase of 8% per year over the last 10 years (1997 to 2007).

Thus, the Moroccan fisheries sector has a lot of development opportunities (in terms of resources, performance and market), but it cannot take full advantage of its potential because of the obstacles against development and blocking factors in terms of organization, systemic and structure

1.2 Fisheries Policy in Morocco

Morocco, located in the extreme northwest of the African continent and is formed of highly productive fisheries namely in its Atlantic coast through the influence of the Canary's cold current and several upwelling outbreaks. Benefiting from this fishery richness, the fisheries sector which knew so far public investment in port infrastructure and private investment in fishing fleets and processing plants, among other, contributes significantly in the national economy and the promotion of exports. At present, however, the sector cannot benefit sufficiently from its strong potential development due to structural causes, which combined with a stagnation of fish catch, and hinders the effective fishery resources. Given such a situation, the Ministry of Agriculture and Marine Fisheries (MAPM) of Morocco in 2009 elaborated the "Plan Halieutis" targeted to year 2020. In Morocco, within the framework of national plans for economic and social development (five-yearly plan) development plans of the fisheries sector were developed every 5 years, which consists mainly of developing fisheries resources in a sustainable and rational manner, and does not undergo major changes in terms of fisheries national policies. The overall objective of this plan is to provide sustainable and competitive fisheries, increasing the value of fishery resources and making the sector with real propulsion for growth of the national economy. To achieve this objective, the development strategy focuses on three major themes, namely: "sustainability", "performance" and "competitiveness, available in 16 strategic projects.

Table 1-1：Strategy and development projects in "Plan Halieutis"

<table>
<tr><td>Sustainability</td><td>Performance</td><td>Competitiveness</td></tr>
<tr><td>Sustainable resource utilization for future generations</td><td>An equipped and organized sector for a optimum quality, for commercialization</td><td>Valorization of fishery products competitive in the diversified markets</td></tr>
<tr><td colspan="3">【Development strategy】</td></tr>
<tr><td>(a) Ensuring the sustainability of fishery resources
(b) Provide the necessary visibility for investment
(c) Promotion of fishers as a primary party for a responsible fishery</td><td>(a) Ensuring the optimum quality conditions in the treatment of seafood
(b) Create more transparency in all the value chains
(c) Ensuring the marketing mechanisms in the functional markets</td><td>(a) Ensuring the availability and consistency of quality of raw material
(b) Conquer market shares at the national and global levels.</td></tr>
<tr><td colspan="3">1) Encourage a true integration in upstream and downstream of the seafood.
2) Improve the collaborative relationships and dialogue between the fishers.</td></tr>
<tr><td colspan="3">[Development Projects]</td></tr>
<tr><td>A-1. Build and share the scientific knowledge
A-2. Develop fisheries on the basis of quotas
A-3. Adapt and modernize the fishery effort
A-4. Make of aquaculture an important source of growth</td><td>B-1. Develop landing infrastructures and equipment
B-2. Dedicate fishing port areas and ensure effective management
B-3. Enhance the attractiveness of fish markets and CAPI
B-4. Organize and boost the domestic market around wholesale and retail markets</td><td>C-1. Facilitate access to the processing industry
C-2. Support the direction for industrialization for fish distributers
C-3. Develop the competitive seafood products in the North, Centre and South</td></tr>
<tr><td colspan="3">D-1. Clarify and complete the legal arrangement
D-2. Ensure effective control and traceability throughout the value chain
D-3. Conduct capacity building and improve the attractiveness of jobs
D-4. Organize professional representation and encourage inter-profession
D-5. Establish a strong public governance to modernize the sector</td></tr>
</table>

Source: Ministry of Agriculture and Maritime Fisheries

【Ambitions amounted for 2020】

Indicator	2007	Progress	2020
i) GDP (fishing, aquaculture and industry) (in billions of DH)	8.3	+13.6	21.9
ii) Direct employment (industry, aquaculture)	61,650	+53,350	115,000
iii) Indirect employment	488,500	+21,700	510,200
iv) Weight of the informal sector (% of sector revenue)	＞30%	1/2	＜15%
v) Exports of seafood (U.S. $ billions)	1.2	x2.6	3.1
vi) Global market share	3.3%	+2.1 points	5.4%
vii) Fisheries production (thousands of tonnes)	1,035	x1.6	1,660
viii) aquaculture production	＜500 t	+200,000 t	200,000 t
ix) Imports (raw material)	30,000 t	x4.3	130,000 t
x) Fish consumption per capita	10 à 12 kg	x1.5	16 kg
xi) Percentage of species sustainably managed	5%	+90 points	95%

Source：MAPM

1.3 Position of the Project within the framework of national policy and strategy

1.3.1 PLAN HALIEUTIS

In 2009, the Ministry of Agriculture and Marine Fisheries developed and published the “Plan Halieutis”, devoting as a development strategy the three major themes: (a) sustainable use of fishery resources, (b) improving the quality of seafood, and (c) strengthening competitiveness through the development of fishery products. Particularly, 3 out of 4 development projects related to the sustainable use of resources: that are, A-1) Build and share scientific knowledge, A-2) Develop fisheries on the basis of quotas, and A-3) adapt and modernize the fishing effort will have to be made through the development of an adequate system of study. Moreover, for accomplishing one of the objectives of the Plan: "To increase the percentage of species sustainably managed from 5% currently to 95% in 2020 (catch volume)", the study data more precise and wider will be necessary. Consequently, the development of a system for the study of fishery resources listed in this Plan Halieutis as one of challenges having the highest priority in all actions to contribute to sustainable fisheries.

1.3.2 Issues related to implementation of policy to achieve « Plan Halieutis »

“Plan Halieutis” has set forth the goal of increasing the percentage of species caught in quota to 95% (ratio by volume of catch) until 2020. While a clear basis exists on this target figure, the Department of Marine Fisheries (DPM) has established, with the aim of reaching a plan every year on the introduction of quotas shown in the table below:

Table 1-2: Target species for quotas establishment

Year	Species sustainably managed (map)	Quotas 2012 introduction species (for information)
2012～2014	Octopus, squid / cuttlefish, small pelagic fish (all areas)	Octopus: 22,000 tonnes (November 2011 - March 2012) and 7,300 tonnes (June-August 2012) Small pelagic fish (South Atlantic): 1,000,000 tons Seaweed (family Gelidiaceae): 14,400 tons Bluefin tuna: Introduction on the basis of recommendations of ICCAT Swordfish: Same Bigeye: 2,100 tons
2014～2016	Swordfish / Bigeye (including catch by foreign fishing vessels), hake, lobster, shrimp	
2016～2018	Coastal species	

Source: Survey from the DPM

Research data that the DPM requested from INRH so as to realize this plan are concerned with: (a) analysis of the actual stocks, (b) state of resources (level and evolution), (c) biomasses analysis, (d) marine environment, (e) resources’ distribution maps, and (f) stock structure (per size, growth stage).

These data are subject of a brief mention in the various assessment reports of INRH, of which the species concerned are limited, and the survey elements and precision are not satisfactory, do not provide sufficient results to achieve the introduction of quotas. DPM, knowing that the reason lies in the fact that existing research vessels do not have sufficient physical features for the collection and provision of data required to enable it to take its decision actions, and questioned particularly the fact that these vessels are not able to undertake studies based on the ecosystem approach taking into account environmental factors, inter-species relation, etc. In addition, DPM considers that a new research vessel is essential to continue the sustainable management of fisheries resources

1.3.3 Strategic Development Plan 2011-2013 of INRH

INRH is the sole governmental body in charge of collecting and analyzing the data necessary for taking the decision of fisheries resources' management actions such as quotas and regulations on the areas and periods of fishing, as well the information to MAPM. INRH operates its two research vessels in maximum to collect and provide the data, but the research capacity of vessels being limited; it can not provide all the data that MAPM requires. On the basis of the above mentioned "Plan Halieutis", INRH developed its three years plan "Strategic Development Plan" (2011-2013), so as to demonstrate as an objective: (a) the implementation and strengthening of fishery stock assessment of a greater extent, (b) intensification of maritime surveillance (25 in 2010 -> 50 in 2013), (c) doubling the number of study days at sea per year (300 days in 2010 -> 600 days in 2013), and (d) doubling of the number of species assessed with estimated TAC / quota (7 species in 2010 -> 14 species in 2013). To achieve these objectives, the construction of the third research vessel is scheduled within the framework of the three-year plan.

1.3.4 Connectivity with the Project

The Project aims to construct a new research vessel adaptable with the diversification of target survey species and expansion of survey zone, and to contribute through strengthening the management capacities of fishery resources for sustainable fishery sector in Morocco. Since the collection and the analysis of fishery resources' data through the operation of a fishery research vessel are important in order to ensure the appropriate assessment and management of fishery resources, the Project is directly related to one of the three major themes above described: (a) the sustainable exploitation of fishery resources. This axis can be realized by the effective exploitation of the research vessel delivered under the present Project.

Moreover, fisheries and aquaculture resources in Morocco are the foundation to support all stakeholders in the country, it is essential to manage a sustainable and meaningful way to ensure a stable supply of seafood to the national and international markets. As described in the section "1.1 Current Situation of Fishery Sector and its Issues", the volume of catches in 2009 and 2010 has increased thanks to the abundant fishery of small pelagic, its production amount has decreased on the other hand. In order to pursue the other two major axes: (b) improving the quality of seafood and (c) reinforcing competitiveness through enhancing the value of these products, it is important to implement a programmed production with a high economic productivity based on the status and fish stock levels, which are reflected by stabilization of fish prices and the enhancing the value of seafood.

Given the foregoing, the Project will not only have a significant impact on the future of the country's fishery sector, but also will contribute in the macro-economy and socio-economic development, including employment, income generation and food safety.

1.4 Cooperation between Morocco and Japan in the fisheries sector

Japan has set, as priority areas for assistance in the development program of its projects in Morocco, "strengthening the international competitiveness / sustainable economic growth", "reducing regional and social disparities" and triangular cooperation". This component "Strengthening international competitiveness / sustainable economic growth" has set as one of the major challenges of development, to ensure the "reinforcing the industrial infrastructure" and opted for strengthening the conservation of fishery resources as a process.

(1) Dispatchment of JICA's Experts

Fisheries experts in short and long term sent by JICA during the period from 1985 to 2000 are among 148 people, or about 10 people per year.
Sending experts in fisheries research vessels proceeded as follows:

- Sending one long-term expert: Advising on assessment methodologies and research of fishery resources (2001 - 2003)
  Advising on engine and machinery of marine research vessel (1993 - 1996)
- Sending one short-term expert: Implementation of acoustic studies through both scientific echo sounders and sonars, as well as the processing and analysis of data (July 13th 2003 - August 26th 2003)

Sending experts to long-term resource management of artisanal fisheries conducted since 2008 to date, resulting in beneficial effects such as contribution to measures against illegal fishing through the immersion of artificial reefs, and increased catches in the vicinity of coral reefs. In addition, this package also led to organizational strengthening of associations of fishing, especially in the form of attempts to poison around artificial reefs at each fishing cooperative. Thus, a prototype for community-based fisheries management is in the process of formation.

(2) Technical Cooperation of JICA project-type

The table below summarizes the technical cooperation project-type conducted by JICA.

Table 1-3: Summary of technical cooperation projects carried out in Morocco

Project Name	Period	Notes
Fisheries Training Project	From 1987 to 1993	11 long-term Japanese experts, 12 Japanese experts in the short term, 19 Moroccan trainees for internship in Japan
Fisheries Technical Training Project	From June 1994 To June 2001	7 long-term Japanese experts, 15 Japanese experts in the short term, 14 Moroccan trainees for internship in Japan
Project for establishment of artisanal fishery improvement and extension system	From June 2001 to May 2006	4 long-term Japanese experts, Short-term Japanese experts (approx. 4 persons/year), Moroccan trainees for internship in Japan (2 – 3 persons/year)
Project for conservation of fishery resources and the use of research vessels	From June 2005 to March 2008	Two Japanese experts in the short term (development and maintenance of acoustic instruments, management and maintenance of the engine), 2 Moroccan trainees for internship in Japan (development and maintenance of acoustic instruments, management and maintenance of the engine)
Valorization project of fishery products	From June 2005 to June 2009	3 Japanese experts in long term, 3 short-term Japanese experts, seven Moroccan students for internship in Japan
Project of monitoring capacity building for sustainable management of small pelagics	From May 2010 to May 2015 (specified period)	3 Japanese experts in long term, 7 short-term Japanese experts, three Moroccan trainees for internship in Japan (project)

Source : JICA

(3) JICA's development survey

The "development plan survey of the fishing villages" conducted from 1996 to 1998, was a about developing a master plan and feasibility study on the promotion of artisanal fishing villages, on coastal Mediterranean and western Atlantic North, and improving the incomes and living conditions of artisanal fishermen.

(4) Non-reimbursable financial assistance

The table below summarizes the achievements of non-reimbursable financial assistance in the fisheries sector, the total in this sector has already reached 15.495 billion yen.

Table 1-4: Summary of non-reimbursable cooperation granted to Morocco

Project Name	Signature of notes exchange	Aid Amount (Million yen)
A training ship with a tonnage of 240	1979	500
Equipment and materials for the training schools of fish (first phase)	1984	320
Equipment and materials for the training schools of fish (second phase)	1985	601
Extension of the Technology Institute of Marine Fisheries of Agadir (ITPM)	1986	641
Development of coastal fishing	1988	561
A training vessel of fishing for strengthening maritime training	1989	197
Extension of the Technology Institute of Marine Fisheries of Agadir (ITPM) (first phase)	1990	1533
Construction of a ship repair yard for offshore vessels in Agadir (2nd phase)	1991	901
Crew training of Marine Fisheries (educational equipment for ITPM Agadir)	1992	475
Construction of a fishery training vessel for fishing more than 600 tonnes, spare parts and fishing gear.	1993	1 466
Construction of two training vessels for inshore fishing	1994	864
Development of two fishing villages (first phase)	1995	755
Development of two fishing villages (second phase)	1996	671
Construction of a training center for marine fisheries in Larache	1997	1 086
Development of the fishing village of Souiria K'dima (first phase)	1998	549
Development of the fishing village of Souiria K'dima (2nd phase)	1999	671
Construction of a fisheries research vessel	1999	1 114
Construction of the specialized technology and utilization of seafood	2001	1 121
Development of a fishing village at Sidi Hsaine (first phase)	2002	515
Development of a fishing village at Sidi Hsaine (2nd phase)	2003	219
Construction of central laboratories of the National Institute for Fisheries Research	2007	968

Source : Website of the Embassy of Japan in Morocco

(5) Dispatchment of JICA volunteers

Once, sending the Japanese Overseas Cooperation Volunteers (JOCV) was concerned in part the fundamental areas of fishing such as fishing gear and methods, but is directed in recent years towards priority areas of policy including national and aquaculture. In addition, during the period of April 2010 to March 2012 in Agadir, one senior volunteer has provided a series of training technology in the Higher Institute of Marine Fisheries (ISPM).

(6) Training course of JICA

From 1985 to 2000, the Agency hosted 94 Moroccan trainees interested in pursuing research in fisheries in Japan.

In recent years it has expanded its efforts in terms of training in third countries (within the framework of South-South cooperation), and from 2010 to 2012, has implemented training "capacity to export fishery products "in favor of students of Mauritania, Ivory Coast, Guinea, Senegal, Benin, Cameroon, Gabon and other African countries. Initially to these efforts, there is the willingness of countries in West Africa to develop and export products consistent with EU standards, in addition, the training needs for control and history management (traceability) occur more and this training is underway in the Scientific Institute of Marine Fisheries of (ISPM) in Agadir. Furthermore, during 2012 and 2014, in the framework of the

training in third countries, the Artisanal Fishery Extension and Promotion (Phase 3) is under execution for providing artisanal fishers and women engaging in fish processing with the refreshing technical training and literacy education and establishing a new system for extension and enlightening of artisanal fishers, in the Technical Institute of Marine Fisheries (ITPM) – Larache.

(7) Cooperation of Overseas Fishery Cooperation Foundation of Japan: OFCF)

i) Technical cooperation project for the development of chopped meat, pellets and processed products of sardine (February 1988 - February 1993)
Area concerned: Agadir, sending three long-term experts

ii) Project for the development of fisheries in surface fish (especially sardines) in the exclusive economic zone of 200 miles and marketing. (February 1997 - January 1999, follow-up: February 1999 - January 2000).
Area concerned: Agadir, sending three long-term experts, and hosting one trainee

iii) Infrastructure improvement project for fisheries development (July 2006 - March 2007)
Area concerned: Calas Iris, sending one coordinator and two short-term experts.

iv) Infrastructure improvement project for fisheries development (August 2008 - March 2009)
Area concerned: Suira Kedima, sending one coordinator and three short-term experts.

1.5 Cooperation with other donor countries and international organizations

Aid activities of other donor countries and international organizations in the field of fisheries were hardly launched before 2010 with the exception of a few listed in the section "2.4.1 Joint studies of cooperation with foreign countries, "they began to be realized from 2010. Actually, "Artisanal Fish Landing Point" (PDA) is implemented and financed by MCC (Millennium Challenge Corporation) / APP (U.S. Agency for Partnership and Progress) of the United State (see Table below).

Table 1-5：Cooperation projects funded by other donor countries and international organizations

Year	Finance	Implementing Agency	Project description
2010	FAO	DPMA	Modernization of artisanal and coastal fisheries (study)
	CFC/FAO	DPMA	Support for the marketing of artisanal fisheries
	EU	INRH	Repairing the hull of the Research Fishery Vessel "AL AMIR MOULAY ADBDALLAH"
2011	EU	DPMA	Lighting device for drift nets
	EU	ONP	Installation of fish handling facilities (in Agadir, Safi, Mohammedia)
2009～12	Russie	INRH	Marine Ecosystem Study
2012	MCC/APP (Etats-Unis)	DPMA	Fish landing points (PDA): (a) Literacy improvement, Improvement of marine protected areas, Installation of the artificial reefs
		ONP	(b) Development of improved fish landing point (to Tifini)
			(c) Development of port infrastructure for artisanal fishing (fishing port of Tan Tan).
			(d) Construction of the landing points (Bhibeh, Sid El Abed, Tafedna, Kaa Srass, Amtar, Sale, Targha, Ksser Sghir, Belouich, Akhfennir)
			(e) Creation of structures for freshwater fishery in favor of artisanal fishing (in Tarfaya, Al Hoceima, Agadir, Sidi Ifni, Ras Kebdana, Larache, Mohamedia, Jebha, Mehdia)
			(f) Support to fish distributers (training, supply of goods)

Source: DPM

Chapter 2 Current Situation and Issues of Fisheries Resource Survey

2.1 Fisheries resource survey and evaluation system

2.1.1 Fisheries resource survey

(1) Current Status of the resources survey

Fisheries resource surveys in Morocco are conducted, at the initiative of the Department of Fishery Resources of INRH, by deploying two existing research vessels, that are "R/V Charif Al Idrissi (CAI)" and "R/V Al Amir Moulay Abdallah (AMA) " belonging to the National Institute for Fisheries Research (INRH), in each survey area, 2 to 3 times per year for demersal fish (5 times for octopus in 2012) and 2 times a year (spring and autumn) for small pelagic fish respectively (see Table below). In addition to these periodic surveys and according to needs, there are also the researches requested by fishery-related organizations. For example, although the main fishing ground of the deepsea shrimp (*Plesiopenaeus edwardsianus*) is located in the North Atlantic coast, the INRH responds to study requests sent by fishery associations about the data for the South coast. In addition, the operation and management of research vessels are provided by the Department of Support in Research of INRH. (See Table 2 -1)

Table 2 -1: Research program of INRH research vessels (2012)

Vessel	Study Zone	Period	Research Depth	Study Objective	Number of days spent in research navigation (in days)			
					Study	Navigation	Total	
N/R Charif Al Idrissi （CAI）	Mediterranean	April, June, December (3 campaigns)	800m	Demersal (monitoring study)	36	15	51	165
	North Atlantic	April, August, October (3 campaigns)	150m	Octopus (monitoring study)	54	24	78	
	South Atlantic	May, November (2 campaigns)	150m	Octopus (ecosystem study)	20	16	36	
N/R Al Amir Moulay (AMA）	Mediterranean	April, September (2 campaigns)	500m	Small pelagic + oceanographic campaign	16	6	22	156
	North Atlantic	May, October (2 campaigns)	500m	small pelagic	22	4	26	
	Central Atlantic	May, October (2 campaigns)	500m	small pelagic	48	4	52	
	South Atlantic	June, November (2 campaigns)	500m	small pelagic	48	8	56	

Source: INRH

In general, the survey elements in these navigations are as follows:

① Demersal fish survey：
  1）Sampling by bottom trawl (1 trawling by 10 square miles)
② Pelagic fish survey：
  1） Acoustic survey by echo-integration system (38/120kHz) (transect interval: 10 miles)
  2） Sampling of pelagic fish by semi-plegic trawl
③ Oceanographic survey:
  1） Observation of water temperature / salinity / DO / chlorophyll by CTD (vertical distribution) and sampling of water at the fixed points
  2） Sampling of plankton / fish eggs / fry and juveniles

The numbers of survey transect lines and measurement stations by existing research vessels are shown in the table below:

Table 2-2: Number of survey transects and stations (current status)

Survey Zone	Mediterrainean	Atlantique Nord	Atlantique Centre	Atlantique Sud	Total
	Saidia - Ceuta	Tanger - Safi	Safi - Cap Bojador	Cap Bojador - Cap Blanc	
Coastal Line (mile)	197	305	520	390	
	190	270	495	165+204(Dakhla-Blanc)	
A. Pelagics & Oceanography					
Ave. distance (D=20-500m) (mile)	12	30	30	45	117
No. of survey transects (vertical to coast)	49	30	53	36	168
No. of survey stations	35	50	80	80	245
Total survey distance (mile)	785	1,205	2,110	2,010	6,110
B. Demersals					
Ave. distance (D=20-1,500m) (mile)	25	40	35	55	155
No. of survey stations (10x10miles)	65	105	*	120	290
Total survey distance (mile)	1,728	2,448	*	3,312	7,488

Source：INRH

Moreover, the survey of demersal species being practiced during the day, night is spent on travel between survey points and areas. On the other hand, the pelagic fish survey that has been practiced during day and night until 2011, but starting from spring 2012, the accoustic survey and the pelagic fish sampling took place during the day only, and the programmed oceanographic survey during the night, so as to eliminate data errors resulting from the difference of diurnal and nocturnal environmental conditions.

(2) Challenges of the resources' survey

Number of days at sea per year (year 2011) of the two existing research vessels reached 173 days (13 campaigns) for R/V "AMA" and 168 days (10 campaigns) for R/V "CAI", which represents generally high exploitation rate. R/V "AMA" is now in charge of investigations daytime only from 2012, it will likely result in an increase in the number of study days.

i) The existing research vessels have constraints in size and survey functions, carrying out with all the efforts for the acoustic survey of pelagic species, but they are unable to continue the oceanographic or biological survey by sampling in a satisfying way. In addition, for the acoustic survey, they are unable to collect data by echo-integration system (bi-frequency). Under these conditions, it became difficult to build resources evaluation system at higher precision (stock assessment based on the ecosystem approach).

ii) The features of existing research vessels are used to study pelagic zone bounded by an isobath up to 500m, and demersal zone with depths up to 800 m (1,000 m maximum). For the prawn also the survey thus reaches 800 m. However, the results of a study conducted by Spain indicates that the shrimp resources are spread up to 1,500 m, it is currently impossible to accommodate all the data necessary to understand the situation of these resources.

iii) R/V "CAI", which has been the subject of a major repair in 2009 and 2010 (replacement of main engine and other equipment) should reach the age of 35 in 2020 and put out of service due to obsolescence. In other words, this rate as of the year 2021, survey campaigns should be done only by the R/V "AMA", there is concern that the survey functionality may significantly drop than the present.

To deal with these challenges, the acquisition of new research vessel is essential.

2.1.2 Resource assessment system

(1) Priority criteria of species assessed with estimated TAC / quota

Species assessed with estimated TAC / quota are commercially important, with the following priority criteria:

i) Species with a high volume of catches (sardine)
ii) High value species (deepsea shrimp, etc.)
iii) Species at a high price and reputation (lobster, etc.)
iv) Species important for export, which the volume of catches significantly dropped (hairtail)
v) Migratory species in areas of Senegal - Morocco (croaker, etc.)
vi) Demersal species exported to European market
vii) Migratory Species unappreciated in Morocco but highly requested in Senegal and Mauritania (Sardinella of warm sea)

The target species of fishing vessels of the EU with access to Moroccan water include sardine, horse mackerel, mackerel, hake, tuna, hairtail, and demersal species. INRH has as a principle to deploy its stock assessment efforts focused on these species with high commercial value and high interests by both domestic and overseas markets, to avoid competition between EU vessels and domestic vessels

(2) The current situation of stock assessment

At the moment, an exception done for tuna subject to the regional management by ICCAT, INRH estimate the Total Allowable Catch (TAC) focusing only on octopus and small pelagic (only in the Zone C: South Atlantic Zone). Moreover, concerning 5 families and 8 species of small pelagic, 4 species of demersal (2 species of hake and 2 species of sea bream), 1 species of crustacea (pink shrimp), species of cephalopods (squid, cuttlefish), INRH continues stock assesment based on the Production model (Grobal), the Length Cohort analytical model (LCA) and the Grobal analytical model (Grobal Analytical). By 2013, INRH plans to launch its new assessment work on nine families of demersal fish, one species of prawn and red corals, and by 2015, to proceed to the evaluation of almost all species. In stock assessment, INRH aims, through the effective utilization of existing data from various studies, including those obtained in the resource survey, an improvement of assessment techniques (transition from the classical production model (Shaeffer (1954)) to the global analytical model based on ecosystem approach). Regarding the techniques for survey and analysis in this transition process, INRH strives to strengthen through activities, outputs and methodologies developed by the JICA technical cooperation project "Project for Capacity Development of Fisheries Resource Monitoring for Sustainable Management of Small Pelagic Resources" (see table below).

Table 2-3: Current situation and targets of stock assesment activities of INRH

	Species	Assessment Method（2011）			Target for Assessment (2013)	Priority
		Production models (Global) /*1	Cohort analytical model by size（LCA）/*2	Global assessment model (Global analytical) /*3		
Small pelagics	Sardine, *Sardina pilichardus*	○	○	-	Global Analytical	1
	Anchovy, *Engraulis encrasicolus*	-	○	-	ditto	1
	Mackerel, *Scomber japonicas*	-	-	○	ditto	1
	Horse mackerel (3 spec.), *Trachurus trachurus, T. trecae, T. mediterraneus*	-	○	-	Global	2
	Sardinella (2esp.) *Sardinella aurita, S. maderensis*	-	○	-	ditto	2
Demersal	White hake, *Merluccius merluccius*	-	○	○	Global Analytical	1
	Black hake, *Merluccius sénégalensis*	○	-	-	ditto	1
	Red mullet (2 spec.), *Mullus barbatus, M. surmuletus*	-	-	-	Global Analytical (2015)	1
	Scabbard-fish (2 esp.), *Trichiurus spp.*	-	-	-	ditto (2015)	1
	Meagre, *Argyrosomus sp.*	-	-	-	ditto (2015)	1

	Kingklip, *Ophidiidae*	-	-	-	ditto (2015)	1
	Common pandora, *P. erythrinus*	-	-	-	ditto (2015)	1
	Besugue, *Pagellus acarné*	○	-	-	ditto (2015)	1
	Pink drade, *Pagellus bogaraveo*	-	○	-	ditto (2015)	1
	Umbra (2 spec.), *Umbrina canariensis, etc.* Dentex (5 spec.), *Dentex macrophtalmus, etc.* Sea bream, *Sparus aurata* Bogue, *Boops boops* Sea bream (7 spec.), *Diplodus senegalensis, D. vulgaris, etc.* Conger, *Conger conger* Scorpion fish (3 spec.), *Scorpaena scrofa, Helicolenus dactylopterus, etc.* Ray skate (27 esp.), *Raja asterias, R. clavata, R. miraletus, etc.* Shark (34 spec.), shark, *Galeus melastomus, Scyliorhinus canicula, etc.*	-	-	-	Global	2
crustace	Pink shrimp, *Parapenaeus longirostris*	○	○	-	Global improved	1
	Prawn, *Plesiopennaeus edwarsiannus*	-	-	-	ditto	1
	Lobster / Large crustaceans, *Palinirus spp.*	-	-	-	Various models (2015)	1
cephalopod	Octopus, *Octopus vulgaris*	○	-	-	Global improved	1
	Squid, *Loligo vulgaris, Illex coindetii, Alloteuthis subulata*	○	-	-	ditto	1
	Cuttle fish, *Sepia officinalis*	○	-	-	ditto	1
highly migratory fish	Red tuna, *Thunnus thunnus*	-	-	○	Global Analytical	1
	Sword fish, *Xiphias gladus*	○	-	-	ditto	1
	Minor tuna, *Euthynnus pelamis*	-	-	-	ditto	1
Red coral		-	-	-	Global	1

(Note)*1: Production Models: Estimation based solely on the volume of catch and CPUE (calculation of boimass without distinction of age)
*2: Length Cohort Analytical model (LCA): Calculation of estimated abundance at age by age, coefficients Fmax etc.
*3: Global Analytical model: Model integrating in LCA class data, data on the volume of catches, CPUE and composition of size, etc.

Source：INRH

It should be noted that in the afore-mentiond JICA's technical cooperation project being implemented, the project activities include: (a) improvement the accuracy of acoustic data (identification of Target strength (TS) and echogram, etc.), (b) development of methodologies for stock assessment based on the ecosystem approach, (c) sharing information between research laboratories and regional centers of INRH), (d) utilization of existing data in stock assessment, and (e) development of assessment methods of coastal ecosystems. Before the new research vessel is constructed, it is expected that stock assessment methods will be developed through the activities of this technical cooperation project.

(3) Report of assessment results at the Ministry of Agriculture and Maritime Fishing (MAPM)

As requested by the MAPM, INRH reports the results of fisheries resource survey and assessement with their scientific opinions. For the moment, these scientific reports related to the introduction of quotas only concern octopus and small pelagics. Main scientific letters submitted to the MAPM during September 2011 up to August 2012 are as follows. All are based on the results of studies conducted by INRH. There are also research reports published by foreign research vessels, but they are not used for resource management.

① For the Direction of Marine Fisheries and Aquaculture (DPMA)

- Transmission of a record of small pelagic catches by the chartered vessel's onboard observers
- Scientific opinion on the order of octopus fishing along the National coastline
- Fishing with artificial light called lampard
- Revision of octopus fishing quota

- Measures proposed for the management of the prawn for the years 2013-2014
- Impacts of Negro at the region of M'diq
- INRH national reports on the fisheries
- Scientific opinion on the cephalopod fishery
- Results of the fisheries assessment campaigns
- Study on strengthening the management plan of the octopus
- Swordfish fishing in the Mediterranean
- Scientific opinion on the resumption of fishing for cephalopods scheduled November 14, 2011
- Results of the stock assessment of cephalopods aboard the R/V CAI October 2011
- Draft law regulating shrimp fishing
- Appearance of juvenile sardine landings in Tan Tan

② For the benefit of the Department of Maritime Fishery Industries
- Potentiality of small pelagic resources in the Moroccan Atlantic

2.2 Situation of navigation and maintenance of existing research vessels

2.2.1 Navigational situation

(1) N/R « AL AMIR MOULAY ABDALLAH (AMA) »

1) General Description
- Completion in 2001, overall length 38.50 m, width 7.80 m members, average draft 3,50 m, 293 tons gross tonnage, main engine 736kW (1,000 PS)
- Endurance about 21 days, 21 persons onboard (including 14 crew and 7 scientists)
- Objective: pelagic resources survey (acoustic + pelagic trawl), oceanographic survey
- Survey elements: distribution areas, physico-biological analysis, biomass, seawater (nutrients, plankton)

2) Navigational situation
- 8 navigations per year (pelagic + oceanography) + other navigations
- Pelagic survey : 2 campaigns a year (autumn and spring) (156 days/average)
- Transect up to the point of 500m depth from shore with interval of 10 miles. The analysis of collected water is made onshore (Casablanca).

3) Issues

i) Meteorological effects
Navigation of this small vessel depend on the sea condition, it refrains from navigating at the scale of Beaufort 5 or 6 (wind speed from 8.0 to 13.8m/s). In the Moroccan Atlantic coast where the north-east wind dominates, the vessel is subject to rolling, because the transect is right angle to wind's direction. Last survey navigation (in June) had a delay of 10 to 12 days because of bad weather.

ii) Constraints related to the number of scientific staff
Number of scientific staff on board is limited to 7 persons maximum so that two teams (2 shifts) cannot be formed. In addition, there are only two laboratories on board, resulting in the limited research work on the vessel. In addition, there are three laboratories on board (oceanographic laboratory, biological laboratory, acoustic laboratory), but their small size limits the scope of our study on the vessel.

(2) N/R « CHARIF AL IDRISSI (CAI) »

1) General Description
- Completion in 1986, overall length 41.00 m, width 8.80 m out of members, average draft 3.90 m, 397 tons gross tonnage, main engine 809kW (1,100 PS)
- Endurance about 30 days, 25 prsons onboard (including 16 crew and 9 scientists)

・ Objective : demersal resources survey

2） Number of the survey days

・ In general, 8 campaigns per year, total number of days at sea 120 to 130 days (fry and juveniles survey was conducted in addition)

3) Areas and methods of survey

The vessel carries out bottom trawl survey along the coast line, in the water depth of 800 to 1,000 m (120m for cephalopod) of the Mediterranean and the Atlantic. One survey grid is 10 square miles, and trawling is done along the lines established in tha past years except the areas of rocks and reefs. In case that the trawl net cannot be towed with 3 trials, the sampling in such grid is given up. The trawling time is 30 minutes, and the trawling speed is about 3 knots. At the Atlantic coast, trawling is done in the direction from south to north along the coast line, trawling is conducted only in day time, and night time is used for displacement. At the front Mediterranean area, trawling is in the direction from east to west along the coastal line.

4） Issues

The vessel usually departs the port even some bad weather. Except some exceptional cases, even if the sea is rough off, it remains at low speed (resisting wind and rain at sea), does not return to port. Beyond the Beaufort scale 7 (wind speed of 13.9 to 17.1 m/s), it fails out. The rolling angle in rough seas is between 15 to 20 degrees. Given that this is not a double-decker boat, during trawling and at the turn of the net in particular, the handling operations seem to be full of risks.

(3) Performed Navigations

The following table shows the number of navigation days and the number of campaigns per year of R/V "AMA" and R/V "CAI" on the basis of survey navigation logs.

Table 2-4: Navigation records of R/V "AMA" and R/V "CAI"

Research vessel	Total number of navigation (times of navigations)			Notes
	2009	2010	2011	
N/R "CAI"	33 days (3 campaigns)	121 days (7 campaigns)	168 days (10 campaigns)	April 2009 to March 2010: Unavailable because of reparation
N/R "AMA"	192 days (14 campaigns)	126 jours (9 compagnes)	173 days (13 compaigns)	
Total	225 days (17 campaigns)	247 days (16 campaigns)	341 days (23 campaigns)	

Source: INRH

For details of the survey navigation records, refer to Appendix 2-1.

2.2.2 Maintenance situation and future prospect

Maintenance status of the existing research vessel R/V "AL AMIR MOULAY ABDALLAH (AMA)" and R/V "CHARIF AL IDRISSI (CAI)" are the following.

(1) N/R « AL AMIR MOULAY ABDALLAH (AMA) »

1) Maintenance

・ Fuel: DIESEL 50 (mild oil) used (same item for sale). Purchased from private contractors.
・ Electricity: During the anchorage at the port of Agadir, the power is supplied to both power and ground auxiliary machinery of the vessel.
・ Since 2001, the overhall repair of engines and generators was done 3 times (2005: Las Palmas, 2006: Casablanca, 2011: Agadir) and entered to dry dock 4 times (2003, 2005 , 2007, 2010: Las Palmas).
・ The maintenance contract was concluded with SIMRAD agent in Casablanca and Agadir.

2) Diagnosis of the vessel

Maintenance status of the vessel (11 years old) is good, and it seems that given its age more than 10 years, if renovation or restoration would put into service until at the age of 29 (year 2030).

Repair status of the vessel by visual inspection is shown in Appendix 2-2.

(2) N/R « CHARIF AL IDRISSI (CAI) »

1) Maintenance

- Dry docking is conducted every 2 years in Casablanca or Agadir.
- Maintenance and engine overhaul is conducted in Casablanca after 20,000 operating hours or every 5 years.
- Main engine (replaced one in 2009) is an ABC brand (Anglo-Belgian) of 1,150 PS.
- Following the general inspection of the vessel in 2009/2010, the most of machineries were replaced / overhauled. Expenses related to these transactions (about 22 million DH) were all covered by government budgets.
- The vessel is subject to periodic inspections of Lloyd once every 5 years.

The above efforts in terms of replacement and general overhaul of engines and machineries led to the decision for navigating the vessel until 2020. Beyond this date, the vessel should go in the direction of off service.

2) Issues

- Electric pump in the bottom of the engine compartment has a lot of rust and deterioration due to humidity in particular.
- Fuel service tank capacity is insufficient (actual 700 liters, it requires at least 2,000 liters).
- Each hydraulic equipment is connected through a single hydraulic system, so that the entire hydraulic system is out of service, if failure occurs at one of these equipment. Since the hydraulic source relies on a hydraulic pump driven by main engine with power intake device, it is necessary to keep the main engine running even if it is just driving a single folding crane.
- The positional relationships between the intake of air and toilets near the bow is so bad that the ventilation air from the first exhale sometimes stink.
- Regarding the main and auxiliary engines, Niigata brand, getting spare parts is difficult because 26 years have passed since their aquisition.

Despite these observations, most of its equipment and facilities can be considered, in general, as maintained in good condition.

3) Diagnosis of the vessel

Taking into account the age of this vessel 26 years since its construction, in relation to “AL HASSANI” fishery training vessel (aged of 17 years) belonging to the ISPM, it is anticipated that an obsolescence status is relatively advanced. The inspection of actual status of the vessel showed that its maintenance status is satisfactory, which justifies the decision of the Moroccan side to keep it navigating until 2020. Its maintenance status is recognized by visual inspection and is shown in the appendix 2-2.

Table 2-5: Annual Maintenance and Repair Status

R/V "AL AMIR MOULAY ABDALLAH"		
Year	Major Maintenance Items	Maint. Cost Currency:MD
2001	Completion	
2002		
2003	Regular maintenance, Dry dock, Hull painting, Zinc plate replacement,	
2004		
2005	Regular maintenance, Dry dock, Hull painting, Zinc plate replacement, Propeller shaft extraction	975 487
	Technical Stop: Repair of two generator engines (Las Palmas harbor ASTICAN shipyard)	
2006	Technical Stop: Repair of main engine (Casablanca port Chantiers et Ateliers)	436 545
2007	Regular maintenance, Dry dock, Hull painting, Zinc plate replacement, Propeller shaft extraction	619 542
2008		586 387
2009		3 744 108
2010	Regular maintenance, Dry dock, Hull painting, Zinc plate replacement, Propeller shaft extraction	1393 456
2011	Technical Stop: Main engine repair and Two generator engines maintenance (Agadir harbor ABC Motres)	1 034 157
2012		
	Operating hours (per year) Main Engine 2,295 hours NO.1 Aux. Gen. Engine 3,200 hours NO.2 Aux. Gen. Engine 3,200 hours	

R/V "CHARIF AL IDRISSI"		
Year	Major Maintenance Items	Maint. Cost Currency:MD
1996	March regular maintenance, Dry dock, Hull sand-blast/painting, Zinc plate replacement, Propeller shaft extraction	
1997		
1998		
1999	July regular maintenance, Dry dock, Hull sand-blast/painting, Zinc plate replacement, Propeller shaft extraction	
2000		
2001	June regular maintenance, Dry dock, Zinc plate replacement, Propeller shaft extraction	
2002	August regular maintenance, Dry dock, Zinc plate replacement, Propeller shaft adjustment	
2003		
2004	January regular maintenance, Dry dock, Hull sand-blast/painting, Propeller shaft extraction	
2005	February regular maintenance, Dry dock, Zinc plate replacement, Propeller shaft extraction	902 201
2006	July regular maintenance, Dry dock, Shell plate inspection, Propeller shaft adjustment, Zinc plate replacement	1211 727
2007		1328 136
2008		750 706
2009	April renewal inspection, Dry dock, Shell plate inspection, Hull sand-blast/painting, Propeller shaft extraction	6 419 635
	Main generator/main switchboard overhaul, Electric motor/pump/hyd. Fishing winch /ref. machine repair,	
2010		3 346 999
2011		490 162
2012	March hull repair, Hull painting repair, Zinc plate replacement, Propeller shaft adjustment, Bulwark repair	625 432
	Operating hours (per year) Main Engine 3,350 hours NO.1 Aux. Gen. Engine 1,580 hours NO.2 Aux. Gen. Engine 1,546 hours	

2.2.3 Utilization status and challenges of current research equipment and materials

Under the roles of existing research vessels, the R/V "AMA" is assigned to the acoustic study of pelagic and oceanographic research, while the R/V “CAI” deals with the search for stocks for cephalopods, shrimps and hake in the North Atlantic and demersal in the Mediterranean.

(1) N/R « AMA »

R/V "AMA" primary mission is assessment and monitoring of pelagic resources through the echo-integration system and semi-pelagic trawl and handles the oceanographic survey at the same time using the CTD and oceanographic observation winch. A part of research equipment as echo sounders and sonars require repair or replacement.

Present status of research equipment and materials are as shown in the table below.

Table 2-6: Present status of research equipment and materials onboard of R/V "AMA"

Elements	Qty	Technical specifications	Status	Notes
Trawl winch	2	Hydraulic, φ20mm×2000m 34.7kN×80m/min	△	
Net winch	1	Hydraulic, 5.0m3, 34.3kN × 45m/min	○	
Line/net hauler	1	Hydraulic, 4.9kN × 80m/min	△	The drum maintenance is required
Bridge crane	1	EFFER25000-3S, load 2.0tf	○	
Oceanographic winch	1	Tsurumi-Seiki (TSK), hydraulic, φ 6.0mm × 500m (SUS) 7.8kN × 50m/min	△	The cable maintenance is required
CTD winch	1	Tsurumi-Seiki (TSK), hydraulic, φ 6.0mm × 500m (armed) 7.8kN X 50m/min	○	
Trawl gallow A	1	Hydraulic, load 5.9kN	○	
Echo-integration system	1	Simrad EK-60, 38kHz/120kHz, analyzer BI-500	○	
ADCP	1	Sunwest SW2000-115, 115kHz, 500m depth	×	Broken down (repair by the manufacturer impossible, replacement with a new unit set under consideration)
CTD	1	SeaBird SBE-911plus	○	
Ichtyometer	1	Digital 0~50cm	○	
Electronic weighing scales	1	Power type, 0 - 6000g	○	
Echo-sounder	1	Furuno FE1282, Logger	×	
Standby sonar	1	Furuno CSH -53	×	

NB: <○: No problem, △: Necessary maintenance, ×: Down and unavailable>

(2) R/V « CAI »

The R/V "CAI" are unable to perform study beyond 800 m deep zones in terms of functionality. Instead of the broken down oceanographic observation winch, a cordless power winch (50 m) is actually used.

The following table summarizes the maintenance of research equipment and materials.

Table 2-7: Present status of reasearch equipment and materials onboard of R/V ”CAI”

Elements	Qty	Technical specifications	Original/replacement	Maintenance status	Notes
Oceanographic winch	1	Tsurumi-Seiki (TSK), electric, φ 3mm × 1,500m, 200 kg of × 114m/min, 5.5kW	Original	×	Down / Unavailable
Bridge crane	1	HIAB 110, hydraulic, load 10.4tf	Original	○	
Trawl winch	2	Uchida Hydraulics, φ 22mm × 3,000m, 4.5tf × 80m/min	Original	△	Warp’s maintenance is necessary
Net winch	2	Uchida Hydraulics, 3.0tf × 30m/min	Original	○	
Codend winch	1	Uchida Hydraulics, 6.0tf × 35m/min	Original	○	
Trawl winch’s control panel	1	Uchida Hydraulics	Original	○	
Contact freezer	1	Nippon Saburoxx, 10 kg of × 6× 9 fois = 540kg/6Hr	Original	○	
(Netsondes)	1	Furuno CN-14B	Original	○	
Standby sonar	1	Furuno CH-12	Original	○	
Echo-sounder	1	Furuno FE-824	Original	○	
Echo-integration system	1	Simrad	Original	○	
Fish net monitoring system		Scanmer	Replacement	○	

NB: [Original/replacement] Replacement: replaced by a new unit, Original: used as such equipment installed in shipbuilding
[Maintenance state] <○: No problem, △: Maintenance required, ×: down and unavailable

(3) Study areas of survey equipment and materials

The table below shows the elements, subjects, and limitations of the survey areas on the survey results on the equipment and materials used.

Table 2-8: Survey limitations of N/R "AMA"

Survey elements	Survey subject	Survey equipment used	Limitations in terms of survey areas
① Semi-pelagic trawling	Pelagic species	Semi-pelagic trawl	Trawling can be up to 500m deep. It should be noted that however the use of cable nets is assumed a high probability at tangle nets spinning and turning (Needs Improvement)
		Trawl winch	
		Fishing net trawl	
		Echo-integration system	2 frequencies (38/120kHz) only available
		Fishing sounder	Used with the echo-integration system
		Fishing standyby sonar	Available for shoal research
② Physical Oceanography	Water temperature, salinity, turbidity, DO, chlorophyll-a	Water sampler and CTD	Study can be up to 500 m deep.
	Direction and current velocity	ADCP	Down. Repair by the manufacturer is impossible, the study using this equipment is impossible
③ Biological oceanography	Phytoplankton, zooplankton, fish eggs, fry and fingerlings	Plankton net, Bongo net, oceanographic winch	Monolayer sampling is the only possible.

Table 2-9: Survey limitations of R/V "CAI"

Survey elements	Survey subject	Survey equipment used	Limitations in terms of survey areas
① Bottom trawling	Cephalopods, shrimps, demersal (hake etc.).	Bottom trawl	Possible trawling up to 800m depth. Given that the insufficiency in terms of cut nets and in joints narrowing the opening of the net, and that the use of sheet is quite inefficient so as to weigh in the scales with the net's form, it is supposed that the bottom reaching rate will not be good (enhancing action is though required)
		Trawl winch	
		Fishing net trawl	
		Fishing sounder	Available for searching demersal fish shoals.
		Fishing standby sonar	The same
② Physical Oceanography	Water temperature, salinity	Oceanographic winch	Instead of the oceanographic observation winch being down, a small winch (50m deep) has already been installed.

2.2.4 Current status of the infrastructures related to the Project

Regarding the relevant infrastructures such as shipyards, repairyards, and repair workshops in Morocco, the informations were collected from ANP (National Ports Agency), and the visual examination was made on port facilities (Agadir, Casablanca, Tanger). Current status of these infrastructures is demonstrated in the Appendix 2-3.

(1) Agadir

i) Shipyard "Chantier Naval Agadir Founty SARL"

Since its creation in 2002, the shipyard has some 20 units of steel boats. In September 2012, 2 units of 34m (L) (on behalf of the Angolien government) have been completed, one unit of 22m (L) (on behalf of the Moroccan private firms) it was under construction. Before any construction, the site uses a consulting design engineers from Spain (sent by the Company Vigo), and proceeds to assembling components imported from Spain and the Netherlands. For dry docking of vessels, it uses the repair yard (Syncrolift) of the PNA. In addition, in March 2011, it repaired the N / R "CAI".

ii) Repair shop "Ateliers & Chantiers d'Agadir & du Souss (ACAS)"

Founded in 1949, the workshop is a part of the same industrial group as CAM based in

Casablanca, represents the largest mechanical and electrical workshop in Morocco. Its workshop covers (1,000m²) built in 1998, is concerned not only with repairing machinery and equipment to the service of the vessel, but also the manufacture of mechanical drills for mining and roofing materials (metal frames etc.). Its workforce of 63 full-time workers passes where applicable to 85 people according to the needs.

iii) Port Facilities

As for the drawing spaces of the new research vessel, it is difficult, at the moment, to find a space for water draft of 5 to 6m in the fishing port's area. Especially during periods of closure, this area is very crowded with fishing boats. The conclusion of a contract for an annual subscription of berths would certainly reserve the space at fixed place, but in return for royalties (the exemption from docking applies only to fishing port area). In these port facilities, the capacity of ground power would be 64A (28A according to the information of R/V "AMA" Captain), drinking water would be used `as freshwater supplies, fuel was directly done from private contractors.

(2) Casablanca

i) Repair workshop "Chantiers & Ateliers du Maroc" (CAM)

Founded in 1944 by the French capital, this workshop is led by Morocco since 1970, is the largest ship repair yard in Morocco. It carries out repair activities from 50 to 60 units per year, and commercial vessels and boats are equal. It is also responsible for the manufacture of structural elements and components serving the land sector (dams, machines etc. earth.) (For details, visit http://www.cam-industries.com/).

i) Local agent of research equipment « SOREMAR »

The agent has four technical branches on the electricity, radio, electronics and telecommunications. It fulfills its mission agent for manufacturers Simrad and Koden for 18 and 17 years respectively, with technical staff including 8 engineers and 25 technicians. Its branches are located in Casablanca, Agadir, Tan Tan and Laayoune. Its geographical coverage extends over Algeria, Tunisia, Senegal, Ghana and the Gambia. The agency has received certification of GL, NK, BV, ABS on telecommunications equipment and navigation (technical certification on equipment maintenance GMDSS). Concerning its achievements, on behalf of the Project of Vessel Monitoring System (VMS) led by the DPM, it equipped until now some 1,500 fishing boats with INMARSATequipment, and plans to equip the other 750 units during the course of the year 2012. It provides a range of equipment to a Spanish shipyard (VIGO Company) and sends its service technicians. Its high mark offers for acoustic research equipment of SIMRAD, the radio equipment of Thrane Thrane (SAILOR), instruments for radio-KODEN FURUNO, GPS and other marine electronics of GARMIN and liferafts of DUARRY.

iii) Local agent of navigation equipment "ISFOMA" (FURUNO agent)

It is the exclusive agent of Furuno in Morocco, which covers not only Morocco but also Mauritania. Even if it is in other countries, the delivery service is available upon request. IFSOMA has 6 engineers and technicians specializing in marine electronics (including one supervisor), and provides the training for 2 technicians in Japan each year, Germany or Spain. Replenishment parts are possible in two or three days.

iv) Port of Casablanca "ANP (National Ports Agency)"

The ANP was created within the Ministry of Equipment and Transport under the Law No. 15-02 of 2006. The agency based in Casablanca, and has regional centers in Nador, Tangier, Mohammedia, Casablanca, Jurf Lasfar, Agadir and Laayoune. Of the 35 ports that are spread over some 3,500 km of coasts, the port of Casablanca, one of the main African ports, remains the largest port on the Atlantic coast. The ANP is responsible for management and operation of all Moroccan ports (except the port of Tanger Med), has contributed so far to the reform and development of economic and industrial activities through the modernization of ports, public port facilities

management, and exercise its powers in security and port administration.

The Port of Casablanca, since its construction in 1917, has seen subject to widening to the sea by a progressive development. The year 2011 witnessed the entry of 3097 boats to the port; the volume of goods handled 17 million tons per year (about 33% of total cargo handled). Goods unloaded or handled include dry cargo, containers, conventional cargo and automobiles. The managing authority of the port is placed in the government, whose operation is open to both public sector and private sector. Among the private operators are currently two companies: MARSA MAROC and SOMAPORT. The Responsibilities of port management are shared by the ANP for commercial ports, and the ONP (National Office of Fisheries) for fishing ports.

Its breakwater dock has a berthing length of 2.870 m, while the total length of berthing structures actually reaches almost 8 km. The depth of the basin of the port is between 7 to 12 m on average. Berthing priority afforded to vessels belonging to the INRH will ensure trouble-free docking space for the new research vessel. It is clear, however, that if it is in use outside the fishing port, it will need to pay the docking fee to the ANP.

Fresh water and electricity are supplied by individual private contractors specialized in these fields. The fuel supply is through a dedicated truck for merchant vessels, and through the installation of refueling existing private sector in the harbor for fishing boats. The type of fuel is light oil, as is the case of the port of Agadir. Thus, the supply of fresh water, electricity, and fuel is not a problem.

The port is equipped, in addition, of a dry dock (can drain it of water under the name of 145m in length x 20m in width, 10,000 DWT, Approximately five hours, primarily intended for vessels with a length equal to or greater than 30 m) and slipways (for construction and repair of wooden boats with 4 rails, 150 m wide, able to haul boats ashore 100 GT maximum).

(3) Tanger

Tanger city has two ports: (a) the port of Tanger City under the authority of the ANP and (b) port of Tanger Med (being expanded and enlarged and entered into service partially) which is managed by the Tanger Mediterranean Special Agency (TMSA) directly controlled by the state through the funding of the royal family. This is the first port of call for trade and fishing, while the latter is a commercial port (primarily for overflow of containers and vehicles). The port of Tanger City managed by the ANP is now ongoing conversion work, including project management which is provided by the Company in charge of Project Conversion (SAPT), after which it will turn into port with fishing area, berthing zone of luxury packages and a marina (for pleasure boats. Next to Existing fishing port, there is right for having WBCSD, setting drydock, vessel repair facility to 200 G/T.

Details on area fishing port during reconversation and expansion are unknown; it is likely that at least there will be no problem with the docking of the new research vessel.

Given the foregoing, the availability of infrastructure in the new research vessel can be summarized as follows:

Table 2-10: Availability of infrastructure for new research vessel

Infrastructure	Operations to be done	Agadir	Casablanca	Tanger
Dock facility	Docking, rest area	○ (Docking difficult at port fishing area)	○ (Docking difficult at port fishing area)	○ (Conversion and expanding works in progress)
Ship repair	Careenage	× (Syncrolift of 500tonnes)	○ （Dry dock of 10,000DWT	× (Without facility)
	Engine repair	○	○	×
	Research and navigation equipment	○ (with agency)	○ (with agency)	△ (without agency)
Fueling facilities	Fresh water	○	○ (Private contractors)	Unknown details (Conversion and expanding works in progress)
	Electricity	△ (lack of power capacity)	△ (Private contractors, Lack of power capacity)	Unknown details (Conversion and expanding works in progress)
	Fuel	○ (Private contractors)	○ (Private contractors)	Unknown details (Conversion and expanding works in progress)

According to the INRH, the two existing research vessels and the new vessel will be respectively assigned to Agadir, Casablanca and Tangier, respectively.
In case of docking or acnhoring at the port fishing area, the docking fee is exempt, but this area is frequently crowded everywhere. However, the port commercial area comparatively leaves space. Accordingly, to ensure a docking space at the home port of the research vessel, we think of a solution by supposing if it docks outside the port fishing area (payment of an annual docking fee).

As for ship repair, it is possible to perform drydocking or painting the hul inl Casablanca, engine repair in Casablanca or Agadir, it is nevertheless desirable to consider repairing in Las Palmas according to the percentage of service needed.

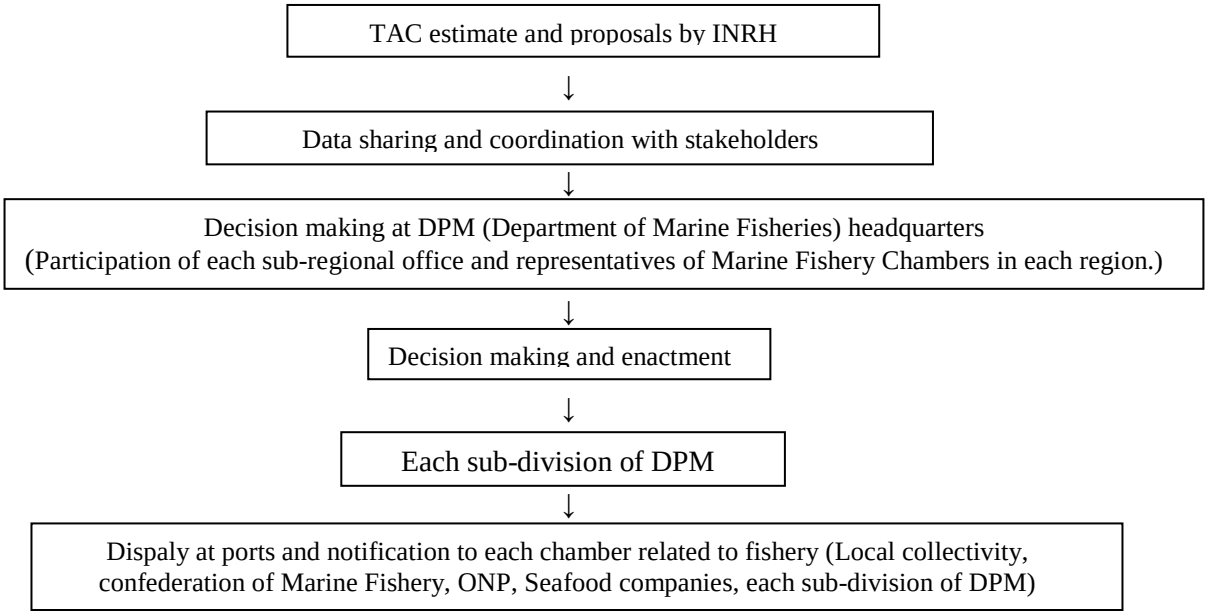
2.3 Utilization of survey results for fisheries development policies and programs

At present, research data are exploited and utilizaed for: (a) scientific support to formulation of the management plan by the Department of Marine Fisheries (DPM) of MAPM and (2) information to fishery-related organizations.

2.3.1 Development and implementation of the Management Plan for Fishery Resources

(1) Development and Implementation Process

Each year, the INRH periodically present to the DPM a set of study reports based on target species (including the estimate TAC quantities and proposals on management measures). Taking into account these reports, the DPM proceeds to the coordination with the different stakeholders in order to decide the measures to apply. Procedue for coordination, decision and information to the concerned parties are as follow:



Introduction of quotas for all species is ensured by the Fishery Resources Conservation Division of the DPMA within the DPM, with an exception of those coastal areas (especially shellfish) whose quotas are defined by the Fishery Structures Division (DSP). Before any quotas introduction, they are subject to the SWOT analysis (strength, weakness, opportunity, threat), and put under the examination of committees created by species to that effect. Thus, the revision of management plan for individual quotas is performed 4 times each year for octopus, one time for shrimp, 2 times for tuna, and also more than 10 times since December 2011 for the small pelagic fish. The results of deliberations of each committee are sent to the Ministry of Agriculture and Marine Fisheries, and approved and enacted under a ministrial order form. In this regard, octopus quota for the running year, that has been initially set forth to 5,500 tons, is exhausted so early in just 4 weeks. The President of the Federation of Marine Fishery Chamber submitted a request to the DPM, who then asked INRH to review its assessment of resources, so that the DPM has allocated an additional quota of 1 800 tonnes.

Here are the key decisions recently published about this regard.

- No.3279-10(2010/12/6) : Decision on the small pelagic fisheries in the South Atlantic coast.
- No.RE/11(2011/10/24 : Decision on shark conservation (modification of (No.RE3/10(2010/9/27)
- No.08/11(2011/7/5) : Decision on the conditions for reopening the fishing of octopus (Summer 2011)
- No.TR04(2012/2/28) : Ministrial Decision on the design of the management plan for bluefin tuna (2012)
- No.04/12(2012/3/26) : Decision on establishing the prohibition of fishing for octopus (Spring 2012)
- No.08/12(2012/5/25) : Decision on establishing the conditions for reopening the octopus fishery in the southern Boujdour (Summer 2012)
- No.15/12(2012/8/13) : Decision on establishing the conditions for prohibition of octopus fishing in the national coastal waters (Autumn 2012)
- No.06/CV/2012(2012/8/16) : Decision on the restriction of the shrimp fishery in their juvenile habitats

(2) Current situation of catches restriction (Quotas introduction)

Current situation of quotas (TAC) introduced in the Moroccan water (as of 2012) are shown in the table below.

Table 2-11: Situation of quotas introduction in the Moroccan water (September 2012)

	Concerned fleet	Concerned area	Qutas Introduction State (TAC)
1) Octopus	Artisanal (LHT less than 7m in length), coastal (less than 50GT) Offshore (less than 50GT)	Artisanal: away, less than 8 miles from the nearest land Offshore: more than 10 miles from the nearest land (12 miles 2 months per year)	From November 2011 to March 2012: 22,000 tons From June to August 15, 2012: 7,300 tons Other periods are closing the fishery. Artisanal fisheries: Quotas by maritime area Coastal fishing: Fisheries restricted, Olympic style Quotas Deep sea fishing: System of Individual Transferable Quota (ITQ) It now plans to establish the TAC maritime zones
2) Bluefin tuna	Artisanal, coastal and deep sea (one single operational unit for the last)	All areas	The recovery plan for bluefin tuna developed in 2010 based on the recommendations of ICCAT and being implemented. The year 2012, marked by adondance of fish caught using net fixed already seen some relaunched 3,000 tunas (220 kg each). Because of this, the calibration period for tuna traps was reduced by 40 days per year to 20 days per yea
3) Swordfish	longliner	North Atlantic and Mediterranean	Established on the basis of recommendations of ICCAT. Olympic style, no fishing when the catch volume has reached 85% of the TAC
4) Small pelagic (5 spec.)	longliner	Mediterranean North Atlantic (Atlantic Centre Stock (Stock B) South Atlantic (C Stock)	The ministerial decree of 2010, which established the TAC (1 million tonnes per year) only for South Atlantic area (Stock C), but there had been a conflit in this area between fishermen difficult to reconcile, so that this order is being reviewed. Because mullet mingle in the nets of sardines, a change is underway in the direction of the admission of such bycatch. Other areas, currently a study, should be assigned for TAC in 2013
5) Seaweed (Gelidiaceae family)	All fishing boats	All areas	14,400 tons / year (Real catch volume: approx. 7,000 tonnes)
6) shrimps (pink)	Bottom trawl	All areas	From January 2011, the process of developing a management plan is in progress. At the present time, we can not establish the TAC. Catching the coastal fishing is possible all year round. However, the catch of each vessel is limited to 10 boxes (16kg / boxes). Deep sea fishing is prohibited during the period from January to February.
7) Bigeye	Longliner	All areas	2,100 tonnes (actual catches of 600 tonnes: weak domestic demand attracts little interest to fishermen.)
8) Deep sea Crustaceans (including lobsters)	Trawler, longliner	Deep area up to 200 m	Bottom trawlers, longliners. area up to 200 m deep. until 2007, only one fishing boat run by a Portuguese captain was operational and the catch was very poor accordingly, but the flotilla has increased gradually after 25 units of small longliners (fish trap) to this day. Operational for eight months each year (closing period: November to March).

Source: Interview to DPM

(3) Other regulations of fishing

Other regulations regarding fisheries are proclaimed and implemented by way of Ministerial order.

1) Regulations on the minimum trading size (for example, anchovies: max. Individuals 60 / kg, sardine: max. Individuals 40 / kg, mackerel, max. Individuals 20 / kg)
2) Prohibition of floating nets with large mesh (20 cm or higher) (from 2011).

2.3.2 Information to fishermen

In order to meet the demands of the fishing industry, INRH broadcasts during the period from 1983 to 1989 and in 2004 fishing ground maps on the Atlantic coast of the country, as well as in 2001 and 2002, maps of fishing ground and sea bottom slope of the Mediterranean coast established by itself and free of charge to fishery-related organizations. However, the map data is outdated, sparse and with low precision, expectations and requests to increase the maps to fishing grounds and sea bottom features that integrate more numerous information. The existing research vessels, which have only very limited survey features, are not able to collect data necessary for responding satisfactory to

the expectations and demands of the fishermen. In addition, the INRH is in a position of undertaking the survey activities mandated by the private sector, so that it leads in this context, recently, a survey service of deepsea shrimp stock.

On the other hand, after seeing the geographical habitat maps of octopus to fishery-related organizations, a lot of fishing boats rushed to taking the best place for each one for an octopus fishery therein. It is therefore necessary to set up a number of rules to the dissemination of information relating solely to the species affected by management measures such as quotas, to prevent over-exploitation of fish stocks, prior to providing informations to fishers.

2.4 Achievements and future perspectives of the joint studies

2.4.1 Joint studies of cooperation with foreign countries

Survey and research conducted in recent years in collaboration with foreign countries are shown in Table below. It should be noted that joint research with Spain, Russia and Norway ended recently, and so far the joint research under cooperation with foreign countries are not programmed. Therefore, it is neessary for the Moroccan government to continue on its own survey and research so far undertaken in the framework of international cooperation

Table 2-12: Joint research under cooperation with foreign countries

	Period	Financial backer	Study content
①	1992	Norway / FAO	Study of pelagic resources conducted by the vessel "Dr. Fridtjof Nansen"
	1995～2006		Study of resources of large extent in 2011 led by the vessel "Dr. Fridtjof Nansen"
	2011		Canary Current Large Marine Ecosystem (CCLME) survey (area between the Strait of Gibraltar and the Guinea Conakry) conducted by the vessel "Dr. Fridtjof Nansen"
②	2001 & 2003～2009	Norway	Study using the existing research vessel "MOULAY ABDALLAH AL AMIR" and "Al Hassani" vessel (also boarding Norwegian researchers)
③	2007	Norvway / France	Study of planktonic using high frequency acoustic equipment
④	2004～2006	Spain	Topographic prospecting sub-marinated in the abyssal zone of the Atlantic (depth of 500-2 000 m) and study of fishery resources conducted by the R/V "VISCANDI DE EZA"
⑤	2009～2012	Russia	Study of marine ecosystems conducted by the R/V "ATLANTIDA" (Atlantic and Mediterranean coast)

2.4.2 Partnership with national institutions (universities etc.).

Partnership arrangements or INRH cooperation with universities (areas of marine resources and environment) only concern: (a) the organization of practical and theoretical lectures presented by INRH researchers for students of faculty and students at the masters or doctoral level, (b) putting under the entire disposal of INRH researchers the university research facilities etc. Regarding demand and expectation on the part of universities, they have a particular interest in the ecosystem studies at the coastal areas and countermeasure against marine pollution, and want to enjoy the new research vessel to allow collecting research data in these areas (while respecting the navigation plan of INRH).

It is also recalled that within the framework of the technical cooperation project of the JICA being implemented, which revolves around a fishing village near El Jadida, the bio-environmental research of the coastal zone is implemented in partnership with local fishermen and master & doctorat students.

2.4.3 Future joint studies

According to the INRH, the new research vessel should be used, 95 to 98% for national needs, to support the "Plan Halieutis". With regard to other requirements, mainly related to joint research with universities and the Ministry of Water and Environment, the INRH will examine case by case each application file if it can certainly bring benefits sufficient to cover its costs.

As for research activities in foreign water, which depend on their survey plans, the INRH may

think, if appropriate, the opportunity to rent or charter the vessels to exterior bodies, but it does not intend to undertake the survey in foreignwater, unless there is a clear vision or a political judgment.

For example, a certain need for survey exists in Mauritania and in Senegal for the continuation of a large extent by R/V Nansen (Norway/FAO) on the Canary Current Large Marine Ecosystem (CCLME), but, at this moment, a concrete program of survey by using the project vessel has not been established.

Chapter 3 Appropriate Contents, Scale and Scope of the Project

3.1 Study concept based on operational situations of existing research vessels

3.1.1 Need for marine cosystem and oceanographic survey

Moroccan exclusive economic zone (EEZ) is composed of: (a) Atlantic Ocean, which is affected by the Canary Current and upwellings and (b) Mediterranean Sea, which is characterized by the impact of the through-flow crossing the Strait of Gibraltar and the sharp slope of sea bottom. Both waters have ecosystems with high complexity and diversity. Although these areas are originally affected by meteorological variations at the regional scale including the westerlies, their ecosystem and fishery resources undergo a wide range of significant influences resulting from the impact as natural climate change on one hand and the human impact such as marine pollution or overfishing on the other hand in recent decades. In such areas marked by great complexity and diversity, it is important to carry out survey and research based not only on the traditional approach focused on basic information such as fishery statistics, but also on an approach that integrates several factors such as environmental information and correlations between living beings, so called, the “ecosystem approach”.

In this context, the new research vessel should be equipped with functions that allow to undertake the ecosystem survey namely focused on physical oceanography, biological oceanography and marine environment, in addition to stock assessment survey conducted so far by the two existing research vessels (R/V "CAI" and R/V "AMA").

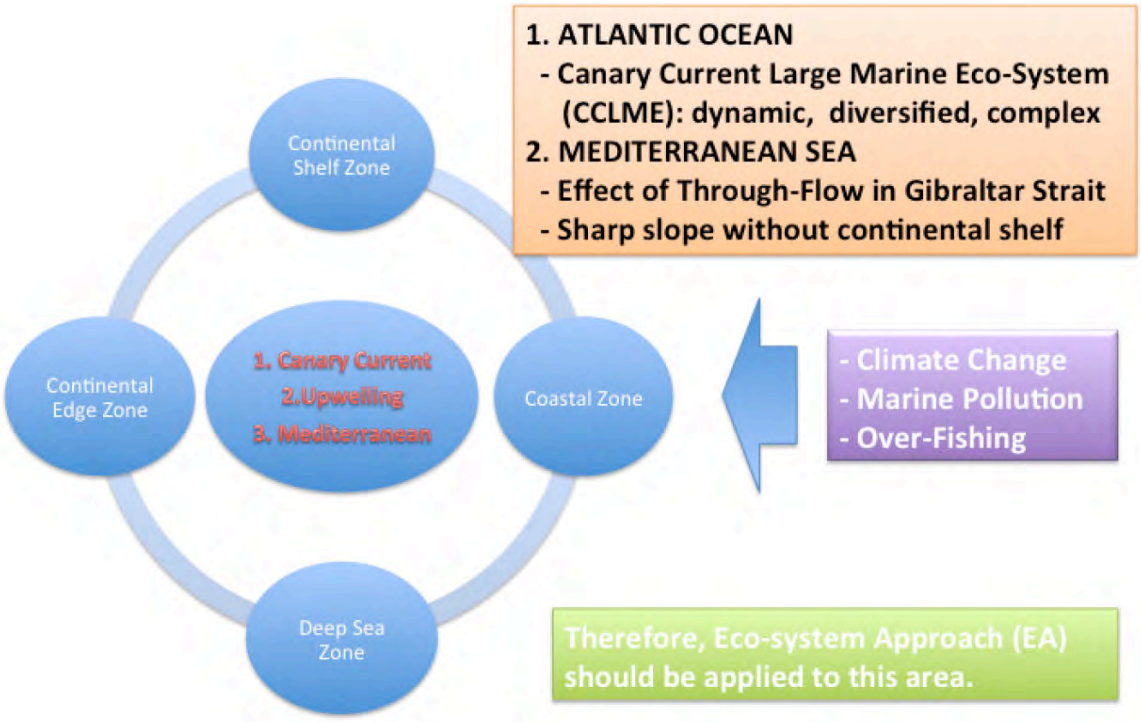


Figure 3-1 : Image of the ecosystem approach

3.1.2 Survey scope of new research vessel

The new research vessel, as shown in the table below, will be implemented in order to allow Morocco to continue, under its own efforts and resources, the survey scope that have been up to now subject to foreign research vessels such as Norway, Spain and Russia (due to low possibility to continue similar survey by these foreign vessels from now on). This is how the new research vessel must be equipped: 1) survey capabilities required by stock assessment survey and ecosystem survey in terms of elements and contents of research, and 2) conducive functions to undertake survey activities in deep water between 1,000 and 1,500m) and the wide-area survey at neighboring countries according to their needs, in terms of survey areas and water depth. The vessel should be more specifically as follows.

i) The existing research vessels have only functions that allow performing limited stock assessment survey at depth from 20 to 1,000 m and a part of ecosystem survey in the Moroccan waters. The new research vessel has to be equipped with survey functions such as those provided in the past researches within the framework of the Project of the Canary Current Large Marine Ecosystem (CCLME) by the Norwegian vessel “Dr. Fridtjof Nansen” (1,444 G/T), as well as in the ecosystem surveys conducted by the Russian vessel “Atlantida” (2,062 G/T) at the Morocco EEZ (Atlantic and Mediterranean Coasts).
ii) While for the survey of deep sea (up to 2,000m depth), a campaign was performed by the Spanish Oceanographic Vessel “Visconde de Eza” (1,000 G/T) discovered the distribution of useful fishery resources (deep sea shrimp in particular) at the depth of 800 to 1,500m. Since nowadays the commercial fishing fleet has established operations with a maximum depth of 1,200m, it is essential to develop as soon as possible the organizational system of the survey and research of the deep sea with a view to the prevention of overexploitation.
iii) Since CCLME includes the maritime areas of Senegal and Mauritania, it is necessary to enable the new research vessel to operate there so as to respond to requests from international organizations and foreign countries.

Table 3-1：Survey scope of new research vessel

Zone	Depth	Research Vessel	Stock Assessment Survey		Eco-System Survey			Remarks
			Environment	Fisheries Resource	Physical Oceanography	Biological Oceanography	Large fauna (nekton and larger)	
Moroccan Water (Mediterranean Sea & Atlantic Ocean)	<20m	-	(To be covered by other project)					
	20 - 1,000m	Moroccan research vessels	(Ambient aquatic environment directly influence the present resources)	Pelagic & Demersal	Temp., Salinity, (DO), Nutrient salt	Plankton, Fish egg & larva		R/V. Al Amir & R/V. Charif (Twice a year since 2002)
		Foreign research vessels	same as above	Pelagic & Demersal	Temp., Salinity, DO, Transparency, Nutrient salt, Chrolophyll-a, Current profile, Bottom sediment	Plankton, Fish egg & larva, Benthos	Seabird / Marine mammal	R/V. F. Nansen (Norway/FAO, 2011)
			same as above	Pelagic (assessment and recrutement)	Temp., Salinity, Nutrient salt, Chrolophyll-a, Current	Plankton, Fish egg & larva		R/V AtlantNiro/Atlantida (Russia, since 1994)
			same as above	Demersal	Temp., Salinity			R/V Ema-Barden (2009 and 2011)
	1,000 - 1,500m	Foreign research vessels	same as above	Deep-sea shrimp	Temp., Salinity, Bottom sediment, Sea bed structure	Benthos	deep-sea fish	R/V. Vizconde D'Eza (Spain, 2004-2006)
	1,500m<	-		(Not prioritized survey zone)				
Foreign Water (Mauritania / Senegal)	20 - 1,000m	Foreign research vessels	same as above	Pelagic & Demersal	Temp., Salinity, Nutrient salt, Chrolophyll-a, Bottom sediment, Current profile	Plankton, Fish egg & larva, Benthos	Seabird / Marine mammal	R/V. F. Nansen (Norway/FAO, 2011)
					: To be mainly covered by a new vessel			
					: To be covered by a new vessel on demand			

3.1.3 Tasks demarcation between new and existing research vessels

① The new research vessel will, in general, develop not only the "ecosystem survey" and the study of deep sea zone (depth of 800 to 1,500m) easily covered by existing vessels in terms of their functions, but also for the pelagic resource survey (acoustic survey with higher accuracy).

② The existing research vessel R/V "AMA" will be used primarily for the demersal resource survey (up to 200 m deep, in autumn), as well as that of pelagic resources (in spring). In addition, the fisheries training vessel “AL HASSANI” of ISPM will be chartered for demersal resource survey (200 – 800 m deep).

③ The existing research vessel R/V "CAI" will be used primarily for monitoring survey of demersal species (inter-calibration with R/V "AMA" and the new research vessel) to be turned off from the third year of the project (2020).

④ If the fisheries training vessel "AL HASSANI" of ISPM is not available, the R/V "AMA" will be installed with bottom trawl net (for 200 – 800m deep) to conduct the demersal resource survey (200 - 800m deep).

The following table summarizes the distribution of roles between existing research vessels and the new research vessel after the construction of the latter.

Table 3-2：Demarcation of roles between new and existing research vessels

	Autumn	Spring
New R/V	Day: Pelagic resource survey (range of measurement lines: 10 000, depth: up to 1 000m) Night: Ecosystem survey (range of measurement lines: 30 miles, 5 points per line)	Day: Demersal resource survey (survey grid: 10 miles, depth: up to 1,500m) Night: Ecosystem survey (range of measurement lines: 30 miles, 5 points per line)
Existing R/V (R/V "AMA")	Day: Demersal resource survey (depth: up to 200m, survey grid: 10 miles) (depth: 200 – 800m, with “Al Hassani”)	Day: Pelagic resource survey (distance of transects: 10 miles, depth up to 1,000m)
Existing R/V (R/V "CAI")	Day: Monitoring survey of demersal species (depth up to 800m, survey grid: 10 miles) (1st year for inter-calibration with R/V "AMA", 2nd year for inter-calibration with the new research vessel, the third year off service)	

3.1.4 Survey elements and contents

(1) Pelagic resource survey

1) Acoustic survey

The echo-integration system onboard the existing research vessel "AMA" is of the type with dual frequency (38/120kHz) commonly used for the stock assessment. Given an orientation of the INRH (Using many more frequencies, in addition to its various efforts made in the survey design and analysis stage, so as to improve the accuracy in determining species of fish in equipment used in studies and research), the new research vessel will undertake the survey using four frequencies (18/38/120/200kHz) for the reasons set out below.

- Additional frequency bands of 18kHz and 200kHz will ensure the identification of small pelagics more effectively (e.g., mackerel is characterized by very strong reflection at all these frequencies 18, 38, 120, 200kHz. Herring and cod accuse 18kHz strongest reflection, which weakens as the frequency increases).
- 200kHz is very useful for identification and elimination of layers of zooplankton.

2) Semi-pelagic trawling survey

In order to ensure compatibility with existing data in the past, a semi-pelagic trawl, with a

catching efficiency similar to that of the existing vessel "AMA", will be installed. Taking into account, however, the situation where pelagic fish sampling is adept at escaping from nets cannot be achieved in a satisfactory way, it is necessary, firstly, to establish the "auto-tension winch system" capable of automatically controlling the length of warps, and secondly, to improve techniques of mid-layer trawling through technical cooperation. Pelagic fish collected will be measured by species, collection of biological information on size/weight, sex ratio, maturity, degree of fat, fat, stomach contents, gonad weight, etc.

(2) Demersal resource survey

1) Bottom trawling survey

The vessel will be equipped with two types of bottom trawls respectively for octopus (depth 0 - 200m) and demersal fish and shrimp (depth 200 - 800), to allow a study of stocks by "area swept" method. Given the compatibility with data of existing vessel "CAI", the catching efficiency of the net will be identical. Demersal fish will be taken to the biological data collection, as is the case of pelagic species.

2) Deep sea trawling survey

A bottom trawl designed for the royal shrimp (from 800 to 1,500m depth) will be newly implemented and installed so as to conduct stock assessment survey by means of “area swept” method. The demersal fish collected will be used for collecting biological information, as it is the case for pelagic species.

(3) Ecosystem Survey

Ecosystem survey conducted by existing research vessels covers only some of its components, namely the CTD survey (water temperature, salinity, DO, chlorophyll) and the sampling of plankton, fish eggs, fry and fingerlings, which are irregularly conducted. The new research vessel will include a wide range of survey elements implemented in the past by foreign research vessels in Moroccan waters.

Survey methodologies adopted by each survey element are as follows.

i) Biological oceanographic survey

- Phytoplankton: Distribution of surface layer and quantification through a dynamic view catching camera (surface distribution)
- Zooplankton: multi-net sampling -> measuring fresh weight, species identification, quantification (vertical distribution)
- Fish eggs: continuous sampling of fish eggs by CUFES (Continuous Underway Fish Egg Sampler) and counting (surface distribution)
- Fry and juveniles: multi-net sampling -> species identification, body measurements (Vertical and surface distribution)
- Benthos: Sampling by the bottom collector -> species identification, body measurements (Horizontal distribution).

ii) Physical oceanographic research

- Sea bottom structure: Sounding by multi-beam echo-sounder and bathymetric mapping
- Water quality: In situ measurement of the water temperature, salinity, DO, chlorophyll a, pH, transparency through the CTD (vertical distribution)
- In situ measurement of the water temperature and salinity by TS (surface distribution)
- Nutrients (PO4, N-NO3, N-NO2, N-NH4): sampling of water -> ground laboratory analysis
- Chlorophyll-a: in situ measurement by CTD (vertical distribution) and in situ measurement using FRRF (surface distribution)

- Total alkalinity/carbon: water sampling -> analysis at onshore laboratory
  Current direction & velocity, and tidal level: In situ measurement by ADCP (vertical distribution), and by a fixed current meter and a water pressure meter (at the upwelling zone) for continuous measurement to investigate the hourly change.
- Bottom sediments: Sampling by the bottom collector -> crushing and sorting on board -> onshore laboratory analysis (particle size / moisture / carbon hydrate content / gravity)
- Meteorology: In situ measurement at the meteorological station (atmospheric temperature, humidity, barometric pressure, and wind speed and direction)

iii) Research on large living beings

- Birds and marine mammals: Survey of the numbers of birds and marine mammals (horizontal distribution)

Elements and details of the survey by the new research vessel and the existing research vessels are as shown in the table below.

Table 3-3：Comparison of survey elements between new and existing research vessels

Survey elements			Existing R/V AMA	Existing R/V CAI	New research vessel
Stock survey	Marine environment	Water quality (temperature / salinity / pH / DO / transparency)	CTD (up to 500m)	-	CTD (up to 1 500m)
	Pelagics	Acoustic survey	2 frequencies	-	4 freq. + scientific sonar
		Trawling survey	Area up to 500m depth	-	Zone up to 1000 m depth
	Demersals	Trawling survey	up to 800m depth	up to 800m depth	up to 1500 m depth
	abyssal	Trawling survey	-	-	
Ecosystem Survey	Large fauna	Birds and marine mammals	-	-	Visual inspection (distribution)
	Biological oceanography	Phyto-plankton	BONGO (single layer, up to 500m depth)	-	Sampling (Multi-layers, up to 1,500m depth)
		Zooplankton	ditto	-	Same
		Fish eggs	-	-	Same
		Fry and fingerlings	BONGO (single layer, up to 100m depth)	-	Same
		Benthos	-	-	Sampling (up to 1,500 m deep)
	Physical oceanography	Sea bottom strcuture	-	-	Bathymetric map (up to 1500 m depth)
		Water temperature / salinity / pH / DO / transparency	CTD (up to 500m depth)	-	CTD (up to 1500m depth)
		Alkalinity / total carbon	-	-	Water sampling, analysis (surface & vertical)
		Nutrients	-	-	Water sampling, analysis (surface & vertical)
		Amount of chlorophyll	ROSETTE (up to 500m depth)	-	In situ measurement (surface & vertical, up to 1,500m depth)
		Current direction and velocity	-	—	In situ measurement (vertical distribution & continuous)
		Bottom sediments	-	—	Sampling sludge, analysis (particle size / moisture / oil quantity / weight)

3.1.5 Survey design

(1) New Research Vessel

1) Number of oceanographic and trawling stations and distance for acoustic survey

i) Autumn Campaign (Ecosystem Survey + Pelagic Survey)

Survey Item		No. of operation				
		Atl. South (Cap Blanc～Cap Boujdor)	Atl. Centre (Cap Boujdor～Cap Cantin)	Atl. North (Cap Cantin～Cap Spartel)	Méd (Cap Spartel～Saida)	Total
No. of survey transects		35	52	30	49	166
Demersal trawl	0–200m	27	18	10	6	60
	200–800m	8	10	10	7	34
	800–1,500m	10	11	9	3	32
CTD / rosette		145	165	100	105	515
Bongo / multinet		65	85	50	70	270
Sediment (benne/carottier)		33	43	25	35	135
Pelagic trawl		80	80	50	35	245
Semi-pelagic trawl		12	13	7	5	36
Multi-bean scan (sea bottom)		9.5	11	8.5	2.5	32
Acoustic survey distance (mile)		2087	2516	1228	692	6523
Inter-transects (mile)		435	794	392	214	1834

(Remarks) CTD / rosette: 5 stations per transect (interval: 30 miles) and one time per every pelagic trawl station.
Bongo / multinet & sediment: 5 stations per transect (interval: 30 miles)
Pelagic trawl: Assumed as almost same numbers of trawl as the existing research vessel "AMA"
Semi-pelagic trawl: One time per 2 days (when encountered with fish school)
Bottom trawl: One time per very survey grid (10 miles)
Sea bottom: One time per every deep-sea trawl point (800 – 1,500m deep)
Acoustic survey: Assumed as almost same distance as the existing research vessel "AMA"

ii) Spring Campaign (Ecosystem survey + Demersal survey)

Survey Item		No. of operation				
		Atl. South (Cap Blanc～Cap Boujdor)	Atl. Centre (Cap Boujdor～Cap Cantin)	Atl. North (Cap Cantin～Cap Spartel)	Méd (Cap Spartel～Saida)	Total
No. of survey transects		13	17	10	14	54
Demersal trawl	0–200m	53	35	20	11	119
	200–800m	16	19	20	41	96
	800–1,500m	19	22	17	5	63
CTD / rosette		186	204	132	162	683
Bongo / multinet		65	85	50	70	270
Sediment (benne/carottier)		33	43	25	35	135
Pelagic trawl		13	17	10	14	54
Semi-pelagic trawl		7	9	5	7	27
Multi-bean scan (sea bottom)		19	22	17	5	63
Acoustic survey distance (mile)		1276	1336	874	773	4259

(Remarks) CTD / rosette: 5 stations per transect (30 miles) and one time per every station for pelagic, semi-pelagic and bottom trawls.
Bongo / multinet & sediment: 5 stations per transect (interval: 30 miles)
Pelagic trawl: One time per transect (30 miles) (when encountered with fish school)
Semi-pelagic trawl: One time per every 2 transects (when encountered with fish school)
Bottom trawl: One time per every survey grid (10 miles)
Sea bottom: Every deep-sea trawl point (800 – 1,500m deep)
Acoustic survey: Along transect (30 miles)

2) Sampling of water and fry / fingerlings (once in the spring and another in autumn)

Survey Area	Number of survey transects	Sampling number					
		Coastal areas (20 to 500m deep)			Abyssal zone (500 to 1 500 m depth)		
		20-100 (Strate 6)	100-200 (Strate 6)	200-500 (Strate 4)	500-800 (Strate 2)	800-1200 (Strate 2)	1200-1500 (Strate 2)
South Atlantic (Cap Blanc - Cap Boujdor)	13	78	78	42	26	26	26
Center Atlantic (Cap Boujdor - Cap Cantin)	17	102	102	68	34	34	34

North Atlantic (Cap Cantin - Cap Spartel)	10	60	60	40	20	20	20
Mediterranean (Cap Spartel - Saidia)	14	84	84	56	28	28	28
Total	54	324	324	206	108	108	108

(2) Existing Research Vessels

1) R/V "AMA"

i) Autumn Campaign (Monitoring survey of demersal resources)

a) Depth 0 – 200m

Survey Item		No. of operation				
		Atl. South (Cap Blanc～Cap Boujdor)	Atl. Centre (Cap Boujdor～Cap Cantin)	Atl. North (Cap Cantin～Cap Spartel)	Méd (Cap Spartel～Saida)	Total
No. of survey transects						0
Demersal trawl	0–200m	120	25	55	30	230
	200–800m	0	0	0	0	0
	800–1,500m	0	0	0	0	0
CTD / rosette		20	8	15	5	48
Bongo / multinet		0	0	0	0	0
Sediment (benne/carottier)		0	0	0	0	0
Pelagic trawl		0	0	0	0	0
Semi-pelagic trawl		0	0	0	0	0
Multi-bean scan (sea bottom)		0	0	0	0	0
Acoustic survey distance (mile)		1200	250	550	300	2300

b) Depth 200 – 800m

Survey Item		No. of operation				
		Atl. South (Cap Blanc～Cap Boujdor)	Atl. Centre (Cap Boujdor～Cap Cantin)	Atl. North (Cap Cantin～Cap Spartel)	Méd (Cap Spartel～Saida)	Total
No. of survey transects						0
Demersal trawl	0–200m	0	0	0	0	0
	200–800m	34	15	50	30	129
	800–1,500m	0	0	0	0	0
CTD / rosette		5	4	10	10	29
Bongo / multinet		0	0	0	0	0
Sediment (benne/carottier)		0	0	0	0	0
Pelagic trawl		0	0	0	0	0
Semi-pelagic trawl		0	0	0	0	0
Multi-bean scan (sea bottom)		0	0	0	0	0
Acoustic survey distance (mile)		340	150	500	300	1290

(Remarks) CTD / rosette: One time per every 3 – 6 bottom trawl stations.
Bottom trawl: Assumed as almost same numbers of trawl as the existing research vessel “CAI”
Acoustic survey: Survey areas for bottom trawl

ii) Spring Campaign (Pelagic resources survey)

Survey Item		No. of operation				
		Atl. South (Cap Blanc～Cap Boujdor)	Atl. Centre (Cap Boujdor～Cap Cantin)	Atl. North (Cap Cantin～Cap Spartel)	Méd (Cap Spartel～Saida)	Total
No. of survey transects		35	52	30	49	166
Demersal trawl	0–200m	0	0	0	0	0
	200–800m	0	0	0	0	0
	800–1,500m	0	0	0	0	0
CTD / rosette		132	148	90	91	461
Bongo / multinet		52	68	40	56	216
Sediment (benne/carottier)		0	0	0	0	0
Pelagic trawl		80	80	50	35	245
Semi-pelagic trawl		0	0	0	0	0
Multi-bean scan (sea bottom)		0	0	0	0	0
Acoustic survey distance (mile)		2087	2516	1228	692	6523
Inter-transects (mile)		435	794	392	214	1834

(Remarks) CTD / rosette: 4 stations per transect (30 miles) and one time per every pelagic trawl station.
Bongo / multinet: 4 stations per transect (30 miles)
Pelagic trawl: Assumed as almost same numbers of trawl as present.
Acoustic survey: Assumed as almost same distance as present.

2） R/V "CAI" (Monitoring survey of demersal species)

i) Number of stations for inter-calibration with the R/V "AMA" (1st year)

Zone	Trawl		Oceanography	Navigation survey distance (mile)
	0-200m	200-800m	CTD	
Cap Blanc – Cap Boujdor	120	34	0	1540
Cap Boujdor – Sidi Ifni	25	15	0	400
Sidi Ifni – Cap Spartel	55	50	0	1050
Cap Spartel – Saidia	30	30	0	600
Total stations	230	129	0	3590

ii) Number of stations for inter-calibration with the new research vessel (2nd year)

Zone	Trawl			Oceanography	Navigation survey distance (mile)
	0-1500m	0-800m	800-1500m	CTD	
Cap Blanc – Cap Boujdor	110	87	0	0	870
Cap Boujdor – Sidi Ifni	125	103	0	0	1032
Sidi Ifni – Cap Spartel	88	62	0	0	618
Cap Spartel – Saidia	80	72	0	0	716
Total stations	403	324	0	0	3236

For details of the study plan and navigation, please refer to Appendix 3.

3.2 Requirements for the new research vessel (design criteria)

3.2.1 Performance of seaworthiness

To improve the accuracy of measuring data in acoustic and oceanographic research and to ensure the observations safely at the fixed points, the vessel will be equipped with an anti-rolling tank and a large anti-rolling fin. An anti-rolling tank will be of variable frequencies type, and will be designed so as to expect the reduction rate of 50% roll under normal conditions of the Vessel. An anti-rolling tank will be installed in the central part of the forecastle deck, and will be designed to reduce as the target rolling angle (at amplitude) at 10 degrees at most, under the wind of Beaufort scale 7 (13.9 to 17.1 m / s) and the significant wave height of 4m (to be applied to the Plan A only as mentioned later).

3.2.2 Number of crews members required on board

The capacity of existing vessels is 21 persons (14 crew members and 7 scientists) for the R/V "AMA" and 25 persons (16 crew and 9 scientists) for R/V "CAI". Given the recruitment of new crew and the performance of existing vessels, the number of scientific personnel will be increased to form 2 teams (2 shifts by day and night) necessary to continue day and night survey operations.

As a general rule, the staff onboard will be as follows:

Officers, non-commissioned officers				Other memebers onboard	
Bridge	Machinery	Deck	Kitchen	Scientists	Co-researchers
Captain	Chief engineer	Boatswain	Chef cook	Chief scientist	Professor
Second Captain	Second engineer	Second boatswain	Cook	researchers(14)	Students of 2/3rd cycle (4)
3rd Officer	3rd engineer	Sailors (4)	Waiter		
4th Officer	4th engineer				
Technician / Engineer	Chief oiler				

	Oiler				
5 members	6 members	6 members	3 members	15 pers.	5 members
				Total	40 members

Remarks: The above numbers show the number of persons onboard in case of the Plan A mentioned later. Total number of perons onboard is 35 except 5 co-researchers in case of the Plan B.

3.2.3 Endurance (capacities of fuel tanks, fresh water, etc.)

(1) Fuel Tank

It will be of sufficient capacity to allow performing navigation and survey activities nonstop and without refueling in the 4 survey zones (North, Central, South Atlantic, and Mediterranean) as detailed in section 6-1. In other words, except the amount required to satisfy the maximum number of days per survey trip (South Atlantic), an amount of fuel equal to 5 days (at the speed of 10 knots / hour) must be loaded, in order to cope with any unexpected eventualities.

(2) Fresh water tank

Taking into account the maximum number of survey days (25.8 days) plus approx. 20% margin, the supply of fresh water will be a capacity to boarding fresh water covering at least 30 days. If the vessel is used for international water, it will be equipped with a tank covering 45 days. Consumption of fresh water (for drinking water and service water) is 30 liters per person per day.

(3) Refrigerators for food etc.

A sufficient quantity of food for at least 30 days will be loaded assuming of meat (5 liters) fish (1 liter), vegetables (10 liters), and dry foods (10 liters) per person per day. When it comes to navigation in international waters, they will have sufficient capacity for at least 45 days.

(4) **Fish hold** (to be equipped to Plan A only as mentioned later)

Based on the volume of catch (2,985 kg/navigation) made in pelagic resource survey with existing research vessel, the fish hold has a volume of about 12m^3, given the fact that the number of days at sea will almost double, and the loading rate is 0.5.

2,908(kg)×2times/0.5(m3/kg) = 11.6m3

Cooling of the fish hold will be by pipe grid, and the temperature in the hold will be maintained at -20 °C.

3.2.4 Engine power and speed required

i) Cruising speed: At least 13.0 knots, under full load, 85% of the driving force with 15% sea margin.

ii) Output of main engine: Main engine shall be a diesel medium-speed (750 rpm / min) capable of satisfying the requirements of cruise described above.

3.2.5 Workspace, storage areas & facilities and equipment for survey

Wheelhouse (the part reserved for the survey), wet lab., semi-dry lab. (for oceanography), semi-dry lab. (for biology), dry lab. (for acoustic), and space for CTD will be sufficient to accommodate the survey equipment listed in the following table.

A : Equipment and materials for resource assessment survey						
	Wheelhouse (compartment observation)	Wet laboratory	Semi-dry oceanography	Semi-dry bilogy	Dry laboratory	CTD warehouse
Echo-integration system, echo-integration sonar	●				●	
Standby sonar	●					
Sonar of bottom mapping (multibeam echo sounder)	●				●	
System of synchronization control					●	
Fish net control system	●					
Doppler current meter (ADCP) multi-layered with ultrasonic type for installation to the hull	●					
Doppler current meter (ADCP) multi-layered ultrasonic for CDT installation(L-ADCP)						●
Ichtyometer, various electronic scales		●				
Microscopes				●		
Freezer		●				
Ultra low temperature freezer, storage for reagents				●		
B-1 : Equipment and materials for the ecosystem study (physical oceanography)						
	Wheelhouse (compartment observation)	Wet laboratory	Semi-dry oceanography	Semi-dry bilogy	Dry laboratory	CTD warehouse
CTD system	●					●
Water sampling system						●
Fluorimeter (FRRF) thermosalinometer, mold mooring . measuring device of speed and direction of hydraulic pressure tide gauge			●			
Mooring system, Multicorer			warehouse			
Automatic meteorological observations	●					
Device for measuring total alkalinity / mineral carbon. production system of pure water production system of ultrapure water, electric sieve, crusher for molecular analysis of sediment, oven, pH meter, electronic scales			●			
Instrument for measuring particle size distribution by the X-ray transmission			INRH Casablanca			
B-2 : Equipment and materials for the ecosystem survey (biological oceanography)						
	Wheelhouse (compartment observation)	Wet laboratory	Semi-dry oceanography	Semi-dry bilogy	Dry laboratory	CTD warehouse
dynamic shots capturing camera, continuous inderway fish egg sampling (CUFES), electronic scale, microscope				●		
Mockness Multi-net, bottom sampler				Warehouse		

3.2.6 Design criteria for cabin spaces of the crew

The location of accommodation premises will have to allow satisfying the conditions of space and layout provided in the following table:

Description	Technical specifications	Number of cabins	Location	Floor area (Note 1)
Captain, 2nd captain, Chief engineer, 2nd engineer	Single cabin (with shower at least for captain and chief mechanic)	4	Forecastle deck or Castle deck	More than 6m²
3rd Officer, 4th Officer, 3rd engineer, 4th engineer, technician/engineer	Single cabin or cabin 2 persons (Single cabin for radio	3 - 5	Forecastle deck or Upper deck	More than 6m²

	operator)			
Boatswain, Chief Cook, Cook, Chief Oiler, Oiler	Single cabin or cabin 2 persons (Single cabin for Boatswain, Chief cook and Chief Oiler)	4 - 5	Upper deck or Second Deck (Note 2)	More than 5m²
Waiter, Deck hands (4), Machine hands (3)	Cabin 2 persons	3	Second Deck (Note 2)	More than 7m²
Chief Scientist	Single cabin (with shower)	1	Forecastle deck or Castle deck	More than 6m²
Scientists (14)	Cabin 2 persons	7	Upper Deck or Second deck (Note 2)	More than 7m²
Co-researcher (Professor) (In case of Plan A only)	single cabin	1	Second deck (Note 2)	More than 6m²
Students 2/3 cycle (4) (In case of Plan A only)	Cabin 2 persons	2	Second deck (Note 2)	Students 2/3 cycle (4)

(Note 1) Surface of the floors take account of including bed and wardrobe. However, the space for the shower compartment is excluded from the calculation of the floor surface.
(Note 2) Second deck is located bellow the waterline.

3.2.7 Others

(1) Level of underwater noise

To improve the performance of acoustic survey, the levels of noise and vibration radiated underwater will be equal or lower than the values recommended by the International Council for the Exploration of the Sea (hereinafter referred to as "ICES"), including through the implementation of measures against noise and vibrations at the hull structure on the one hand, and the adoption of the main engine, propellant, and various equipment with low vibration and low noise on the other hand.

Level of underwater noise:

The measurement consists of immersing an omnidirectional hydrophone to a remote point of 30 to 100m from the starboard side at 10m or 20m of depth and measure therein the noise level at the vessel's velocity of 10 knots during the acoustic survey operations. The level of acoustic pressure of noise as measured will be compensated compared to the length of the bandwidth, so as to allow calculating the noise spectral level; this value has to satisfy ICES criteria described bellow.

ICES criteria: 135 - 1.66 log (f) or the lower band of 100Hz to 000Hz 1, 130 to 22 log (f/1000) or the lower band of 1kHz to 100kHz (130-22log (f/1000) (f: frequency in Hz).

Unit of measurement: dB re 1 µPa (1Hz band) at 1 m

(2) Noise and vibration inside the vessel

The noise level in living quarters etc. shall not exceed the following values compliant with the IMO Resolution Res. A468 (VII) during navigation (80% of power output), while the vibration levels must meet the criteria of ISO 6954:2000.

Cabins : Equal to or less than 60dB (A)
Mess room, laboratories : Equal to or less than 65 dB (A)
Machine control room & workshop : Equal to or less than 75 dB (A)

(3) Generators

To provide power for the hydraulic equipment such as bow thrusters and deck machinery, as well as the required electric power, it is scheduled to provide 2 main diesel generators (In addition, one diesel generator designed to operate during mooring / anchoring is equipped in case of Plan A). The power supply will be of AC 380 V, 50 Hz; and the number of operational generators at the normal cruise and survey/observation will be 1 unit, and 2 units in case entry and exit of port and during fishing.

To avoid the extent possible, and the power generation engine establishes noise on strong common bed too, and do two folds of flexible mountings. Moreover, the generators machines are equipped with different measures tending to reduce noise as much as possible, and at the same time will be supported on a common solid P equipped with a double anti-vibration.

(4) Dynamic positioning system

A high level of performance is required, particularly in dynamic positioning during observations using CTD etc. For navigation at very slow but steady for a long time during the investigation through different objects being towed, tracking along the predetermined transects, etc., the vessel shall be equipped with a dynamic positioning system suitable for a diverse range of movements: ahead / astern, turn left / right, circling, turn on the spot, etc., by mean of the integrated control of the steering gear high lift, the variable pitch propeller and bow thruster.

(5) Fishing gear

The new research vessel, assigned to perform survey of pelagic and demersal requires both a semi-pelagic trawl and bottom trawl. Given the lack of staff with techniques for semi-pelagic trawling does not perform satisfactorily sampling of pelagic fish, the vessel shall be equipped with a auto-tension winch system) for automatic handling of fishing gear, and further provided with two winches of net respectively dedicated to semi-pelagic trawl and bottom trawl in order to perform an efficient the replacement operations of fishing gear.

(6) Fish Measurement Work Room (Wet Laboratory)

The new research vessel will be equipped with fish measurement work room (wet laboratory) under the superstructure deck (on upper deck) in order to avoid the fish handling in the open air, so as to drop fish from superstructure deck to fish bin in fish measurement room in which fish can be carried through a conveyor. In addition, the fish storage will be installed in case of Plan A as mentioned later. The capacity of fish storage is approx. 12 m^3 with inner temperature of -20℃.

(7) Vessel type and the power of winch

The vessel shall be of a trawler type with two full substructures (double deck) with slipway in the stern, and will have a winch power for trawling described below.

- Semi-pelagic trawl : Depth 20-1 000m towing speed of 5 knots, targeting pelagic fishes
- Bottom trawling : 0 to 200m depth, trawling speed of 4 knots, targeting octopus.
- Bottom trawling : Depth 200 to 800m, towing speed of 4 knots, target: demersal & shrimp
- Deep trawling : Depth 800 to 1 500m towing speed of 3 knots, target: royal shrimp

(8) Toilets, bathrooms, etc.

In anticipation of the participation of women as a scientific personnel onboard, the vessel will have lavatory, bathroom and washbasin specially for women.

(9) LAN communication system

The vessel shall be equipped with a local area network (LAN) to collect data for navigation, machinery, meteorology and oceanographic observation, and distribute this information to the terminal display screen installed at different locations in the whole vessel.

(10) Spare parts control system, etc.

The vessel shall be equipped with a local area network (LAN) to collect data for navigation, machinery, meteorology and oceanographic observation, and distribute this information to the terminal display screen installed at different locations in the whole vessel.

(10) Classification, qualification, navigation areas

It is necessary to obtain classification of Nippon Kaiji Kyokai (NK), namely, NS * (Fisheries

Research Ship) and MNS *.

Designed for navigation in international waters, navigation areas on GMDSS will be sea areas A1 + A2 + A3.

(11) Codes and regulations as well as applicable inspections.

It is necessary to construct the new research vessel and in accordance with codes and regulations listed below and to submit them to inspections by the competent authorities.

1) Rules and Regulations of the Classification issued by NK
2) International Convention on international tonnage, 1969
3) International Convention for the Prevention of Collisions at Sea 1972 including latest amendments
4) International Convention for the Safety of Life at Sea, 1974 Including its Protocol of 1988 and latest amendments
5) International Convention for the Prevention of pollution by Vessels, 1973, as modified by the Protocol of 1978 and 1997 and Relating thereto Including latest amendments
6) Protocol of 1988 relating to the International Convention on Load Lines, 1966 as amended in 2003
7) International Telecommunication Convention, 1982 Including latest amendments
8) International Convention on the Control of Harmful Anti-fouling Systems on Vessels, 2001
9) Rules of International Code on Intact Stability, 2008 (2008 IS Code).

As mentioned in the section "1.6.3 Codes and regulations as well as applicable inspections" we inquired about the position and the government's policy on the applicability of the "MLC 2006" (international agreement) and "SPS 2008" (international code) described below, which relate to the new research vessel, it became clear that they will not apply them.

.

i) Convention du travail maritime de 2006 - OIT (MLC 2006 : Maritime Labour Convention, 2006 - ILO)
ii) Recueil de règles de sécurité applicables aux navires spéciaux de 2008 - OMI (SPS 2008 : Code of Safety for Special Purpose Ships, 2008 - IMO)

3.3 Facilities and equipment for various surveys

3.3.1 Choice criteria

Data on the biological characteristics and status of fish stocks and marine environments (habitat of aquatic organisms) are essential to promote resource management, conservation of marine environment and biodiversity, based on scientific evidences.

The main objective of the projected fishery research vessel is to contribute to the further study for the evaluation of biomass and ecosystem survey, through acoustic survey and sampling survey. With regard to survey equipment required for this purpose, the review is done in terms of the need and the appropriateness to install and load each of these equipment, taking into accounts the functions and details of survey required by the research vessel. The selection was made on the basis of the principles described below.

i) Selection must be appropriate in light of the administrative and industrial needs of fishers etc., and training and university research, etc.
ii) In terms of quantitative improvement of studies and research relating in particular to survey data accuracy, and expanding survey areas particularly in terms of water depth, the retained equipment are necessary in the light of strategies and future survey objectives, and based on the current global and regional needs.
iii) It is necessary to ensure that various survey and research equipment of the new fishery research

vessel are fully utilized without dead time, given the experience and ability of staff onboard.

iv) Knowing that such analysis of sea water components or plankton identification, there are some activities that require speed in analytical works, and whose treatment on the vessel would be indispensable. For the selection of survey equipment and materials, it should allow confirming the appropriateness of treatment of data and samples on board, through the verification of actual practices and issues of analysis works carried out so far on land.

3.3.2 Relationships between survey design and survey equipment

Planned surveys are divided into 2 areas: "stock assessment survey" and "ecosystem survey." The component "stock assessment survey" is implemented through the sampling survey using fishing gear, CTD system and multi-layer net and acoustic survey involving a system of echo-integration and sonar in particular. The component "ecosystem survey", meanwhile, is composed of a series of physical oceanography, marine environment and biological survey, which are also implemented through both acoustic and sampling survey. Through the respective study methods, a diverse range of elements of study are: (a) measurement and sampling -> (b) processing and analysis -> (c) storage. The correlations between survey areas, survey methods and survey equipment are depicted in the figure below.

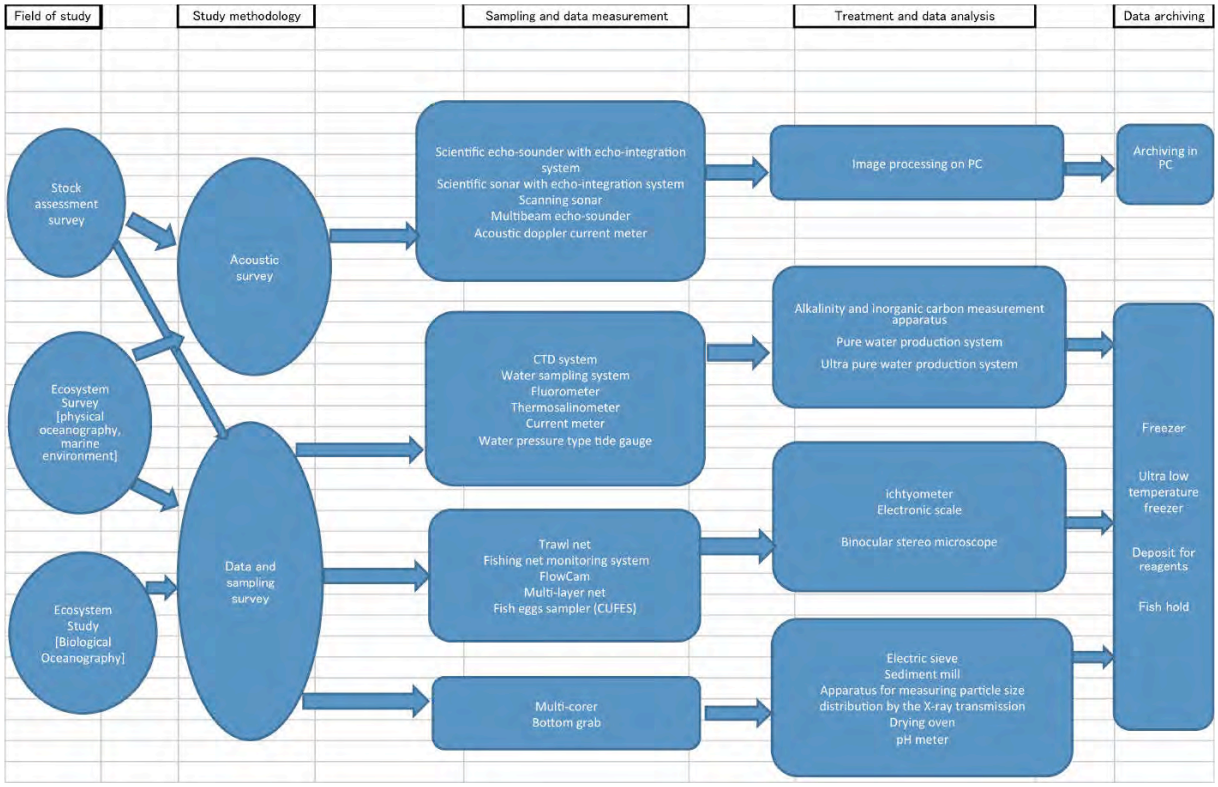


Figure3-2：Relationships between programmed survey and survey equipment

3.3.3 Survey equipment and materials

Taking into account the sections 3.3.1 and 3.3.2 above, the selection of equipment and materials required for stock assessment survey and ecosystem survey was made. In conclusion, the main equipment and materials deemed necessary and sufficient for the research vessel are as follows.

(1) Equipment and materials for stock assessment survey

A. Acoustic Survey equipment

	Resources assessment survey		Qty	Reference model	INRH experience in use	Notes
A-①	Scientific echo-sounder with echo-integration system	4 frequencies, 18/38/120/200kHz	1	Simrad EK60	Experience in R/V. AMA	In addition to 38 and 120kHz frequencies normally used in the existing research vessel "AL AMIR," the addition of 18 kHz and 200 kHz, a total of four frequencies appears suitable for improving the accuracy in the determination of species fish. 200kHz is useful for the identification and separation of layers of plankton
A-②	Scientific sonar with echo-integration system	70 – 120kHz	1	Simrad ME70	No (need to extend technical assistance)	If MS70 (multibeam) requested by the Moroccan side, which requires a retractable keel, would be implemented, there would be a major influence on the design and structure of the body so as to exceed 2000 G / T; accordingly the application was rejected. Alternatively, ME70 (multibeam echo sounder) + SX-90 (sonar monitoring circumferential @). Shall be implemented.
A-③	Scanning sonar	20 – 30kHz	1	Simrad SX90	Experience in R/V. AMA and CAI	
A-④	Multi-beam echo-sounder for sea bottom mapping	70 – 100kHz	1	Simrad EM710	Experiences in Spanish R/V. Visconde d'Eza (2004-05), Emma Barden (2009) and Heripericas (2009)	Given a strong demand on the part of fishermen's associations, it is essential to accumulate observational data of the topology of the seabed, in the context of the development of the fishery resources of the large deep. Instead of EM300 (6 000m bathymetric capacity) requested, EM710 (capacity 500m bathymetric 1) will be implemented, cheaper model and better performance in terms of accuracy in shallow areas compatible with the depth of study under one 500m
A-⑤	System of synchronization control		1	SimradK-SYNC	No experience needed due to automatic device.	Necessary to ensure the timing adjustment during the simultaneous use of multiple devices to survey acoustics.
A-⑥	Fishing net monitoring system	Sensor: trawl. trawler. trawler eye, depth, water temperature sensor, range sensor wing	1	Scanner Scanbas	Experience in R/V. AMA and CAI	Required to display forms of semi-pelagic trawl.
A-⑦	Acoustic doppler current meter (ADCP)	150kHz, 400m range	1	RDI VM-150	Experiences in Russian R/V. Atlantino and the above Spanish R/V (2 staff).	Since the ADCP installation type in the mold hull (VM -150) can only cover up to 400m deep,the ADCP can be mounted on CTD will be implemented to measure the direction and speed of 400m 1 500m current.
A-⑧	Acoustic doppler current meter attached to CTD (L-ADCP)	Potée1500m	1	RDI L-ADCP	ditto	

B. Equipment for trawling survey

	<Trawl Net>		Qty	Reference model	INRH experience in use	Notes
A-⑨	Pelagic trawl net	For small pelagics	2		Experience in R/V. AMA	1 set for spare.
A-⑩-1	Bottom trawl net	For octopus up to depth of 200m	2		Experience in R/V. CAI	ditto
A-⑩-2	Bottom trawl net	For fdemersl fish and octopus, depth 200 – 800m	2		ditto	ditto
A-⑩-3	Bottom trawl net	For demersl fish and shrimp, depth 1 000 – 1 500m	2		Experience by the INRH staff (former captain of trawlers)	ditto

C. Equipment for data processing and treatment of samples onboard

	<Data and sampling processing onboard>		Qty	Reference model	INRH experience in use	Notes
A-⑪	Ichtyometer	Electronic	2		No problem due to easy operation.	
A-⑫	Electronic scales	Weighing max. 60 kg Accuracy 5g	1		No problem due to general equipment	Body measurements by caught species
A-⑬-1	Electronic scales	Weighing max. 3 kg Accuracy 0,1 g	1		ditto	Body measurements of fish samples
A-⑬-2	Electronic scales	Weighing max. 800g Accuracy 0,1 g	1		ditto	Body measurements of organs and fish gonads
A-⑭	Binocular stereoscopic microscope	with camera	1	NIKON AMZ1000	ditto	
A-⑮	Inverted microscope	trinocular with eyepiece 10x18, camera	1	Leica DM IL	ditto	

D. Equipment for preservation of samples onboard

	<Conservation of samples on the vessel>		Qty	Reference model	INRH experience in use	Notes
A-⑯	Freezer	-25 °C, 365 L, with 3 caissons	1		No problem due to general equipment	For conservation of fish, water, sandy sediments (common use)
A-⑰	Ultralow temperature freezer	-86°C, 35L	1		ditto	For preservation of organs, entrails, gills of fish etc.. (common use)
A-⑱	Deposit for reagents	100 – 200L, with alarm	1		ditto	To conserve reagents etc., (common use)

(2) Equipment for ecosystem survey (Physical oceanography)

A. Equipment for data collection and samplings

	<Data collection and sampling>		Qty	Reference model	INRH experience in use	Notes
B-①	CTD system	For measurement of temperature, salinity, depth, fluorescence of water. Resistance to pressure 6,800 m.	1	SBE911Pplus	Experiene in R/V. AMA	The normal depth of water sampling strata 12: 0, 10, 20, 30, 50, 75, 100, 200, 300, 500, 1,000, 1,500 m will be increased to 24 layers, as in changing strata must be collected water most densely by observing the profiles of temperature, salinity etc.. Also a quantity of 5L is required to ensure the measurement of several parameters such as nutrients, DO, alkalinity, total carbon, chlorophyll and calibration with measured values of CTD.
B-②	Water sampling system attached to CTD unit	Rosette water samplers 5L x 24 with inverted thermometer	1	SBE32	ditto	
B-③	Fast repetition rate fluorimeter (FRRF)	With seawater intake pump	1	Turner Designs 10AU™ Field Fluorometer	ditto	Continuous measurement of chlorophyll-a (surface distribution)
B-④	Thermosalinometer	Measurement of temperature and salinity	1		Experiences in Russian R/V. Atlantino (2 staff)	To identify the distribution of surface temperature of the water and salinity
B-⑤-1	Self-recording type current meter	With sensors of temperature, salinity, depth, turbidity, dissolved oxygen	4	AANDERAA RCM 11	Experience in German R/V. Poseidon (2009).	Continuous observation of direction and velocity in the upwelling area (2 sets are needed to observe simultaneously and to compare relativeness at upwelling area and coastal area.)
B-⑤-2	Mooring system for current meters	Float, shroud, anchor, acoustic release device	2		ditto	
B-⑥	Self-recording type thydralic pressure tide gauge	Hydraulic pressure type	1	AANDERAA WLR7	Experience in lagoon and coastal survey.	Install at the marine bottom of the same observation points that the currentmeter is at the bottom of sea as well as observation stations and mold mooring, current speed, total direction of the current and measuring the level of sea float in continuous feed upwelling areas.
B-⑦	Multicorer	Sandy marine sediment sampling	1		Survey experience by installing IFREMER's gear on R/V. CAI.	
B-⑧	Automatic meteorological observations		1		Experience at national meteo. station.	

B. Equipment for data processing and treatment of samples onboard

	<Data and sample processing onboard>		Qty	Reference model	INRH experience in use	Notes
B-⑨	Measuring devices of alkalinity and mineral carbon		1	MARINDA VINDTA 3C	Experience in Gibraltar Strait joint survey with Mericades Univ. of Spain (2007) (2 staff)	Impossible to set measurement parameters, you must perform the measurement in laboratories aboard the vessel
B-⑩	Pure water production system	For chemical general experientation and machines washing	1	dvantec Toyo RFP542HA	Existing in INRH labo.	Common use in laboratories
B-⑪	Ultra-pure water production system	Used for the washing of fish tissues and organs	1	Advantec Toyo RFU414CA/CB	ditto	Common use in laboratories
B-⑫	Electric sieve	Pre-treatment of sandy sediments	1		ditto	
B-⑬	Crusher for molecular	Pre-treatment of sandy sediments	1		1 INRH staff trained in Spain.	
B-⑭	Instrument for measuring particle size distribution by the X-ray transmission	for marine sediments, 0 – 2,000 micron	1	SediGraph 5100	No (need to extend technical assistance)	Possible to analyze samples brought back to ground. Central laboratories of the INRH do not have this tool, it will be implemented in the framework of this project
B-⑮	Drying oven	0-250 °C, measure dry weight / moisture	1	Memmert Type 300	No problem due to general equipment	Necessary to dry sandy sediments and plankton
B-⑯	pH meter	For floors, display: pH 0.01	1		ditto	Measure pH of sandy marine sediments
B-⑰	Electronic scale	Weighing max. 3 kg Accuracy 0.1 g	1		ditto	Weight measurements of wet and dry sandy sediments

(3) Equipment for ecosystem survey (Biological oceanography)

1) Equipment for data collection and sampling

	<Collecte de données et échantillonnage>		Qty	Reference model	INRH experience in use	Notes
C-①	Plankton sizing and analyzing apparatus	0.2-200um	1	Fluid Imaging Technologies FlowCam	No (need to extend technical assistance)	To acquire images of phytoplankton etc. and analysis and quantization size
C-②	Multi-layer net	Opening 500 x 500 5 net bags, length 250 cm, 300 micron mesh	1	Hydro-Bios MultiNet Type Midi	Experiences in Norwegian R/V Nansen and French R/V.	Trawling hybrid horizontal / vertical
C-③	Fish Eggs Sampler (CUFES)	with pump	1		No (need to extend technical assistance)	sampling and counting fish eggs
C-④	Bottom grab	Benthos sampling	1	Smith McIntire	Experiences in INRH.	

2) Equipment for data processing and treatment of samples on board

	<Data and sampling processing on board>		Qty	reference model	INRH experienece in use	notes
C-⑤	Electronic scale	Weighing max. 800g Accuracy 0.01g	1		No problem due to general equipment	Body measurements of plankton, fish eggs, fry and fingerlings
C-⑥	Binocular stereoscopic microscope	with Camera	1	NIKON AMZ1000″	ditto	Observation of fish eggs, fry and fingerlings
C-⑦	Inverted Microscope	trinocular with eyepiece with 10x18, camera	1	Leica DM IL	ditto	Observation of plankton

Among the models above given for guidance, echo-integration system, echo-integration sonar, scanning sonar, multi-beam echo-sounder, multi-layer net are subject to a comparative study, as shown below.

i) Echo-integration system (Scientific echo-sounder)

Reflection principle: To make a comparison between the brand SIMRAD (Norwegian) and SONIC (Japanese) of an international celebrity.

Requirements: Must be an echo-integration system with four frequencies (18, 38, 120, 200 kHz).

	SIMRAD EK60	SONIC KFC3000
Main features	4 frequencies of 18, 38, 120, 200kHz	3 frequencies of 38, 70, 120kHz
Example of implementation	* Oscar Dyson (5 frequencies 18/38/70/120/200kHz) * Henry Bigelow (5 frequencies 18/38/70/120/200kHz) * Pisces (4 frequencies 18/38/70/120kHz) * Yoko Maru (4 frequencies 18/38/70/120kHz) * Koyo Maru (5 frequencies 18/38/70/120/200kHz) * Kagoshima Maru (4 frequencies 12/38/70/120kHz) * In addition, more than 70 units of foreign vessels, more than 20 units of Japanese vessels	The model has been enhanced in the joint research between National Institute of Fisheries Engineering of Japan and NOAA as well as the international common research based on the Antarctic Treaty in particular. 2009/10 Fishery research vessel of the Prefecture Hyogo "Tajima" 2005/11 Natl. Res. Inst. of Fisheries Engineering "Taka Maru" 2003/03 Tohoku Natl. Fisheries Res. Inst. "Wakataka Maru" 2003/01 National Institute of Fisheries Research Agency "Soyo Maru" * In addition, more than 10 units of Japanese vessels
Price	¥51,930,000	¥20,780,000
Local agent	Yes	After sales service available by Turkish agent
Note	The international standard most famous today.	Also widely recognized in the member countries of CIEM
Overall assessment	◎ (The model was installed in the existing research vessel, and recognized globally)	△ (moderately priced and generally recognized, but not matching the technical specifications required for the Project)

We therefore adopt SIMRAD EK60 as initially planned.

ii) Echo-integration sonar (Scientific Sonar)

Reflection principle: To make a comparison between Japanese brands, because as foreign products, SIMRAD brand is very famous, but difficult to handle.

Requirements: Must be able to understand and quantify the tri-dimensional structure of pelagic fish shoals

	SIMRAD ME70	FURUNO FSV-30R
Main Features	Type multibeam (70 - 120 kHz) Transducers attached to the hull.	24kHz Can move the transducers of the hull vertically

Examples of installations	* IMR (Norway) * 6 units at NOAA * Oscar Dyson * Bell M. Shimada * Reuben Lasker * In addition, more than 10 units of foreign vessels have equipped with this model. * Seikai National Fisheries Research Institute "Yoko Maru"	Norway: LIBAS, KVANNOY, ZETA Japan: National Fisheries University "Koyo Maru", research vessel equipped with purse seine "Daiichi Soho Maru"
Price	¥144,000,000	¥41,410,000
Local agent	Yes	Yes
Note	Extremely difficult to handle. Yoko Maru took approximately one year to complete testing and tuning. Challenges in terms of operation of this product are as follows: i) Calculation of TS beam (by frequency) ii) Methods of calculation of average tridimentional TS iii) Influences due to the refraction of the beam in the diagonal direction iv) Development of calibration software v) Sensitive to noise influences Licence renewal Echoview analysis software is expensive	(a) Displaying shoals quantities (b) Calculation in terms of identification, direction of travel and speed shoals automatically detected (c) Recording, retrieval and output CSV data (d) With features "2D Map" capable of displaying historical echoed on Overall assessment grids
Overall assessment	△ (The fine tuning of images is difficult; the degree of complexity in handling is high.)	◎ (This is an echo-integration sonar developed on the basis of fishing sonar, cheaply and relatively easy to handle.)

It is certainly advisable to adopt FURUNO FSV-30R in terms of operation and cost, but it is possible that these difficulties in terms of operating SIMRAD ME70 will be resolved in the near future, we adopt for the moment SIMRAD ME70 and proceed thereafter to the review taking into account changes in situation relating thereto during the detailed design phase (preparation of tender documents).

iii) Scanning sonar

Reflection principle: Sonar of Fishing usage, there are many brand products. To establish the comparison here between the mark and the overall SIMRAD renowned Japanese brand (RURUNO) very efficient.

Requirements: Must be a circumferential sonar and able to explore the surrounding fish shoals.

	SIMRAD SX90	FURUNO FSV-35	SONIC KCS-3220Z-C
Main features	20 ~ 30 kHz Can move the transducers of the hull vertically	2~ 1 27 kHz Can vertically move the transducers of the hull	24 kHz Can vertically move the transducers of the hull
Example of installations	・G.O.Sars ・Oscar Dyson In addition, more than 20 units of foreign vessels ・ Seikai National Fisheries Research Institute "Yoko Maru" ・Metropolis of Tokyo "Miyako"	Norway: LIBAS, KVANNOY, ZETA Japan: National Fisheries University "Koyo Maru", research vessel equipped with purse seine "Daiichi Soho Maru"	2011: 8 units abroad, 4 units in the country 2010: 13 units abroad, 6 units in the country 2009: 12 units abroad, 8 units in the country 2008: 10 units abroad, 6 units in the country
Price	¥43,270,000	¥29,800,000	¥35,560,000
Local agent	Yes	Yes	After sales service available by Turkish officer
Note		The echo-integration sonar (FSV-30R) is also equipped with	Significantly higher than foreign competitors in terms of

		this feature in case of adoption of FSV-30R, this model would not be necessary.	performance.
Global assessment	△	◎ (FSV30R can be used as model)	○

We therefore adopt FURUNO FSV-35. In addition, if we finally adopted FURUNO FSV-30R in (ii) "Sonar of echo-integration" above, also having the functionality of sonar monitoring, models in this section are no longer required.

iv) Multi-beam echo-sounder

Reflection principle: Given that in terms of performance and ease of handling, there is not much difference among the brands recognized globally, consisting of SIMRAD, SEABEAM, SEABAT etc, choose a model at an affordable price and easy to maintain.

Requirements: Must be able to draw maps of Undersea up to 1 500m depth.

	SIMRAD EM710	ELAC SeaBeam3050	Reson SeaBat7111
Main features	70～100kHz Depth up to 1 500m Swath angle maximum130°	50kHz, 1.5°×2° Depth up to 3,000m Angle Swath maximum140°	100kHz, 1.5°×1.9° Depth up to 1,000m Angle Swath maximum150°
Examples of installations	[Examples of introduction for foreign research vessels] * KNM "Tyr" * Rainier * « L'espoir » * In addition to 45 units [examples of introduction of Japanese research vessels] * National Fisheries University "Koyo Maru" * Maritime Safety agency "Takuyo" * JOGMEC "Shiramine" * Other 4 units	10 cases	12 cases
Price	¥82,800,000	¥88,000,000	¥85,000,000
Local agent	Yes	No (Unknown)	No (Unknown)
Note		Effective depth more than 2,000 m	Effective depth more than 700 m
Global assessment	◎ (Despite its somewhat high price compared to the other two models, but it is a model that can meet the required specifications more fully in the project.)	○ (Despite its somewhat low price compared to the model SIMRAD at left, it has disadvantages in terms of accuracy in shallow sea.)	△ (The depth of the water does not meet the required specifications.)

We therefore adopt SIMRAD EM710 as initially planned.

v) Multi-layer net

Reflection principle: Given that for the multi-layer net, its mechanical parts are breakable regardless of brand, to choose one model at an affordable price and easy to maintain in terms of changing parts and repair components.

Requirements: Must be a multi-layered fry net.

	MOCNESS Net (USA)	MOHT Net (Japan)	HYDRO-BIOS Midi (Germany)
Main features	Horizontal multi-layers towing net (with 9 nets) Opening of net 50cm x 50cm mesh size of sieve: 333 μ Horizontal towing: 2.5 knots max.	For multi-layered horizontal towing Opening of net 1,8 m x 2,2 m Number of nets: max. 5 nets. Dyneema net diameter 260mm	horizontal Trawl net and vertical multi-layers (with 5 nets) Opening of net 50cm x 50cm 300 μ: mesh size of sieve Horizontal towing: 4 knots max.

	Water depth: 500m Use of armored cable (impossible to use in offline mode)	Water Depth: up to 1,200m	Vertical towing 1m / s max. Water depth: 3,000m Use of armored cable (optional, can use it in offline mode)
Examples of installations	Implementations made the most numerous in the world, some 200 units already delivered. [Main examples in Japan] Hokko Maru (10m2, 1m2), Wakataka Maru (4m2), Soyo Maru (1m2), Yoko Maru (1m2/4m2 hybrid, 1 m2), Kaiyo Maru (1m2), Syoyo Maru (1m2) , University school vessel (4m2, 1m2, 1/4m2), each vessel of research for fisheries experimental stations (1m2, 1/4 m2)	・Yoko Maru ・Kaiyo Maru	Of the German brand, many deliveries made in Europe and its surroundings. But it did not have deliveries made in Japan.
Price	¥13,840,000	¥19,000,000	¥9,010,000
Local agent	The BESS has sales agents in Europe, but not in Morocco.	NO	Services are provided in Europe, in general, by the head office in Germany. No agency in Morocco.
Note	MOCNESS net is a system which allows to collect plankton and juvenile horizontally by dredging, and at the same time to obtain a variety of information on environmental sampling with instant using various sensors: The sensor of environment, accessory using standard thermometer saltwater, conductivity (salinity) and hydrometer, you can optionally set up a variety of sensors such as fluorometer and quantometer.	Developed by the National Research Institute of Fisheries Science/Tokyo University of Marine Science and technology (fabricant: Nichimo).	The net is a MultiNet system with the main objective of the sampling horizontal and vertical plankton and fry. it does not attach importance to the acquisition of environmental information at the time of sampling. The environmental sensor, standard accessory is limited to hydrometer. It is possible to add optional sensors for temperature and conductivity (salinity), but not possible to bring other environmental sensors such as fluorimeter, as is the case for MOCNESS net.
Global assessment	○ (Expensive)	△ (Expensive)	◎ (The cheapest)

We therefore adopt HYDRO-BIOS Midi as initially planned.

3.4 Comparative examination in terms of size and content

3.4.1 Development criteria of option plans

The selection of option plans is made on the basis of the following criteria.

i) Required survey functions (possibility to explore up to 1,500 m depth) will practically be satisfactory.
ii) Minimum effective complement (20 crew, 15 scientists) may be allowed.
iii) At least 30 days of endurance will be ensured in accordance with the survey design.
iv) Given the ease of operation and maintenance, the size of vessel will not be too large.
v) Propulsion system will be of a diesel engine taking into consideration of maintenance.
vi) The vessel will be of trawler type with double deck to facilitate the survey work onboard.
vii) Both semi-pelagic trawl and bottom trawl will be equipped independently and respectively.

3.4.2 Comparison of option plans

Based on the criteria mentioned above, we assume two stock option plans: Plan A (recommended) and Plan B (alternative). As shown in the table below, the results of comparative examination plans are listed in the table below.

Table 3-4：Comparison of option plans

		Plan A (recommended)	Plan B (alternative)
Principals	Gross tonnage	About. 1,100G/T	About. 800G/T
	Length Over All (LOA)	About. 60.40m	About 49.99m
	Width	About. 11.60m	About 10.40m
	Projected displacement at full load	About. 3.40m	About. 3.70m
	Main Engine	Diesel 1,838 kW (2,500 PS)	Diesel 1,437 kW (2,000 PS)
	Maximum autonomy	9.300 miles (at 12 knots)	7.800 miles (at 12 knots)
	Exploration autonomy	30 days (reserve fuel: 250m3) 45 days (freshwater reserves and food) With fish hold (12m3, -20 ℃)	30 days (reserve fuel: 210m3) 45 days (freshwater reserves and food) Without fish hold
	Staff number onboard	40 people (28 cabins) (20 member crew, 20 scientists)	35 people (22 cabins) (20 member of the crew, 15 scientists)
	Cruiser speed	About 13 knots	Approx. 12.5knots
Survey area		Moroccan areas + neighboring countries areas	Moroccan areas
Survey depth	Pelagic survey	Area bounded by the curve isobath to 1,000 m	Same as left
	Topographical study underwater	Up to 1,500 m	Same as left
	Demersal survey	Up to 1,500 m	Up to 1,200m
	Oceanographic survey	Up to 1,500 m	Same as left
Onboard laboratories		Approx. 93m^2 1- room treatment and measurement of catches 2-Oceanographic Laboratory 3-Biological Laboratory 3-Acoustic Laboratory	Approx. 70m^2 Same as left Same as left Same as left Same as left
Joint research with universities		Possible (1 professor + 4 students 3rd or 2nd cycles)	Difficult (if there would be a kind vacant for scientific personnel to board)
Foreign joint study areas		Possible Study areas of Large Marine Ecosystem Canary Current (CCLME).	Study is difficult because of limitations in terms of duration and distance of autonomy (the need for repeated stops midway resulting in an increase in cost).
Vessel Stability (BF7, significant wave height: 4m at the research stoppage)		Roll angle of about 10 ° (5 ° with anti-roll tank in action)	Roll angle of approximately 13 ° (without anti-roll tank)
No. of days possible to do survey		347 days / year (capable to do survey up to BF7)	312 days / year (capable to do survey up to BF6)
Construction cost (Production cost)		Approx. 4.44 billion yen	Approx. 3.66 billion yen
Navigation and maintenance costs (including staff costs)		Approx. 21.7 million MAD (approx. 190 million yen) (annual average)	Approx. 18.3 million MAD (approx. 160 million yen) (annual average)

Moreover, a comparison of the expected benefits of each of these two plans is established in qualitative assumption as shown in the table.

Table 3-5：Comparison of benefits

		Plan A (recommended)	Plan B (variant)
Economic benefits	①Constant catch of pelagic and demersal fish	◎	◎
	②Developing the resources of prawn (Royal shrimp)	◎ （1,000～1,500m）	○ （1,000～1,200m）
	③Transformation and development of unexploited deepwater species	◎ （1,000～1,500m）	○ （1,000～1,200m）
	④Improving the efficiency of catching	◎ (up to 1,500m deep)	○ (up to 1,200m deep)
	⑤Sustainable development of industries processing fisheries products / Improved	○	○

	market value on the international market		
Social benefits	①Early detection and reduction of marine pollution	○	○
	②Increase in employment opportunities for researcher	○	△
	③Increasing the number of students in 2nd and 3rd cycle of marine environmental sciences	○	×
	④Stable supply of fishery and aquaculture products	○	○
	⑤Contribution to regional and sub-regional cooperation	○	×

The layout general plan of the vessel (Plan A and Plan B) is shown in Appendix 4-1. The comparative table of the main technical characteristics of existing research vessel (R/V "CAI" and R/V "AMA"), the new research vessel (Plans A and B) and R/V "Yoko Maru" Japanese given for information are shown in Appendix 4-2.

Chapter 4 Plan and Schedule for Project implementation

4.1 Objective of the project

The objective of the project is to strengthen scientific research capabilities on fisheries resource by constructing a new fishery research vessel in conformity with the Plan Halieutis of the Moroccan government, in order to contribute to sustainable management of fisheries resource and development of fishery sector in Morocco. The project consists of the construction works (construction of the Vessel including procurement of survey equipment and materials) and the consulting services.

4.2 Construction plan

4.2.1 Construction in Morocco

In Casablanca, there is a dock with a length of 145m at the disposal of ANP. It is, however, dedicated to repair activities, has no experience in the construction of new vessels. Agadir has a shipyard "Agadir Founty SARL", that constructed more than 20 units of steel ships since its creation in 2001. However, it has neither dry docks nor slipways, and constructs small-scale steel boats in flat areas in the shipyard, so it is not able to deal with the construction of large ships. In addition, Tangier has only facilities for ship refit and repair gross tonnage of 200 tons, next to his fishing port.

For the foregoing reasons, the planned construction of the vessel in Morocco was considered impossible, and it is necessary to construct in overseas countries.

4.2.2 Eligible shipyards in Japan

The table below summarizes the constructions made in Japan regarding large-scale fishery research vessels (including fishery training vessels).

Table 4-1: Large-scale fishery research vessels and fishery training vessels constructed in Japan

NO.	Vessel name	Category	Owner	Completion year	Length Over All	Molded breadth	TJB international shipyard	Vessel name
①	Kaiyo Maru	N/R fisheries	Fishery agency	1991.07.31	93,01	15.00	2942	Mitsui Engineering & Shipbuilding
②	Shoyo Maru	N/R Fisheries	Fishery agency	1998.05.12	87,60	14.00	2494	Nippon Kokan
③	Soyo Maru	N/R fisheries	Fisheries Research Agency	1994.10.28	67,50	11.40	1234	Mitsubishi Heavy Industries
④	Wakataka Maru	N/R Fisheries	Fisheries Research Agency	1995.03.24	57,73	11.00	990	Mitsui Engineering & Shipbuilding
⑤	Syunyo Maru	N/R Fisheries	Fisheries Research Agency	2001.04.27	66,31	11.40	1228	Niigata Shipbulding & Repair, Inc.
⑥	Hokko Maru	N/R Fisheries	Fisheries Research Agency	2004.08.31	64,73	11.90	1246	Niigata Shipbulding & Repair, Inc.
⑦	Yoko Maru	N/R Fisheries	Fisheries Research Agency	2010.11.30	58,60	11.00	991	Niigata Shipbulding & Repair, Inc.
⑧	SEAFDEC	Fishery training vessel	SEAFDEC	1993.02.10	65,02	12.00	1178	Miho Shipyard Co., Ltd.
⑨	Shinyo Maru	Fishery training vessel	Tokyo University of Marine Sciences and Technology	1984.12.10	60.02	10.60	936	Sumitomo Heavy Industries

⑩	Shinyo Maru	Fishery training vessel	Tokyo University of Marine Sciences and Technology	2000.06.30	93.00	14.90	3,391	Mitsui Engineering & Shipbuilding
⑪	Koyo Maru	Fishery training vessel	National Fisheries University	2007.06.29	87.59	13.60	2,703	Mitsubishi Heavy Industries
⑫	Kagoshima Maru	Fishery training vessel	Kagoshima University	2012.03.30	66.92	12.10	1,284	Niigata Shipbuilding & Repair, Inc.

In the list of shipyards qualified by the Government of Japan (all Ministries) for open tenders, the Class A includes (1) Mitsui engineering & Shipbuilding Co., Ltd., (2) Mitsubishi Heavy Industries, Ltd., (3) Sumitomo Heavy Industries Marine & Engineering Co., Ltd., (Sumitomo Heavy Industries, Ltd.,) (4) Japan Marine United Corporation (Nippon Kokan), and the Classe B includes (5) Niigata Shipbulding & Repair, Inc. (6) Miho Shipyard Co., Ltd., who have experience of construction of fishery research vessels. The shipyards are classified by the government on the basis of financial performances such as capital and turnover, the number of staff, into 4 classes, A, B, C and D. The required qualifications for the tender of R/V “Yoko Maru”and R/V“Kagoshima Maru”were Classes A and B. Consequently, in Japan, these contractors can be considered as shipyards capable of constructing the project vessel.

Furthermore, it should be noted that the most of fishery research and training vessels above mentioned are of diesel engine propulsion. Two vessels (Kaiyo Maru and Shoyo Maru) belong to the Japan Fisheries Agency and the R/V “Koyo Maru” are of a great scale more than 2,500 G/T, which allows providing a large space of the machine room, so as to adopt the hybrid mode. Also, the R/V “Kagoshima Maru”which uses 2 azimuth thrusters, produces a large torque to the propeller during steering, so hat high-torque electric motors were adopted.

4.2.3 Relevant fishery research vessels constructed in foreign countries

The table below shows the fishery research vessels from 1,000 to 2,000 tons constructed by foreign countries other than Japan over the past 10 years.

Most of the fishery research vessels built in the western countries are of the electric propulsion, which built in the shipyards of own country.

Moreover, it is supposed that the R/V Mirabilis, built by STX Finland and delivered in June 2012 to the Government of Namibia, adopted the diesel propulsion system, taking into account that local crew are not accustomed to handling electric propulsion machines.

Table 4-2: Fishery research vessels constructed in foreign countries (Last 10 years)

Countries	Vessel name	Owner	Completion year	Propulsion mode	Length Over All (m)	Molded Breadth (m)	Draft (m)	International gross tonnage	Shipyard
UK	CEFAS ENDEAVOUR	CEFAS	2003	Electric 2,230kW	73,92	15.80	5.50	2,983	Ferguson Shipbuilders
USA	OSCAR DYSON	NOAA	2005	Electric 2,300kW	63.80	15.00	6.00	2,218	Halter Marine, Inc.
	HENRY B. BIGELOW		2006	Electric 2,300kW	63.80	15.00	6.00	2,218	
	PISCES		2008	Electric 2,250kW	63.80	15.00	6.00	2,218	
	BELL M.SHIMADA		2009	Electric 2,250kW	63.60	15.00	6.00	2,218	
Norway	G.O.SARS	IMR	2003	Electric 8,100kW	77.50	16.40	6.00	3,800	Flekkefjord Slipp & Maskinfabrikk
Ireland	CELTIC EXPLORER	Marine Institute	2002	Electric 3000kW	65,50	15,00	5,65	2,425	Damen Shipyard
Italy	NAVE URANIA	ISMAR	2010	Electric 1,000kW	61.30	11.10	3.60	1,115	Mario Morini
Spain	SARMIENTO DE GAMBOA	CSIC	2006	Electric 2,400kW	70.50	15.50	4.60	2,979	P.Freire
	MIGUEL OLIVER	Min M.Anb	2007	Electric 3,400kW	70.00	14.40	4.80	2,495	Montajes Cies SKL

	INTERMARES	Tragsa-tec	2009	Diesel 2,290kW	79.20	15.00	N/D	2,954	Astilleros Armon
	RAMON MARGALEF	IEO	2011	Electric 900kW	46.70	10.50	4.20	988	Astilleros Armon
Namibia	MIRABILIS	MFMR	2012	Diesel 3,200kW	62.40	14.00	4.70	2,131	STX Finland

4.3 Equipment plan

4.3.1 Foreign products

Fisheries research vessel built in Europe and Japan are equipped with survey equipment and materials of some particular manufacturers. Given the possibility of undertaking joint surveys between the INRH and European countries and neighboring ones, data sharing and maintenance of these equipment and materials, should be appropriately made, so that these foreign products should be purchased and equipped through agents and distributors in Japan. The table below shows the main foreign products.

Table 4-3: Foreign products to be equipped in the project vessel

Description	Brand and Model	Manufacturing country	Agent	Justification of choosing foreign products
CTD system Water sampling system	Sea Bird SBE 911plus SBE32	USA	EMS	An equivalent product is not manufactured in Japan. Implemented in the R / large size of Fisheries Research Agency (Yoko Maru. Wakataka Maru). For foreign vessels, implemented in the R / GOSARS (Norway), NAVE Urania (Italy), Ramon Margalef (Spain).
Acoustic doppler current meter (ADCP)	T.RD Instrument ADCP、L-ADCP	USA	Hydro System Develop	
Scientific echo-sounder with echo-integration system	SIMRAD EK60	Norway	Nippon Kaiyo Co., Ltd.	Equivalent, more than 4 frequencies, is not made in Japan. Considering the price, it is possible to adopt the SONIC brand, however, 2 standard frequencies and 3 maximum frequencies. For foreign vessels, implemented in the R / GOSARS (Norway), Ramon Margalef (Spain).
Scientific sonar with echo-integration sytesm	SIMRAD ME70	Ditto	Ditto	An equivalent product is not manufactured in Japan, but it is possible to adopt FCV30R brand of Furuno given its ease of use and its price. For foreign vessels, implemented in the R / V Ramon Margalef (Spain).
Scanning sonar	FURUNO FCV-35 (SIMRAD SX90)	Japan (Norway)	Nippon Kaiyo Co., Ltd.	Manufactured by the two companies in Japan: FURONO AND SONIC given the ease of use and price. We adopt Furuno FCV-35. The echo-integration FSV-30R sonar of Furuno above also includes the function as a scanning sonar in case of final adoption of the FSV-30R, FSV-35 would not be necessary. For European vessels, SX90 is implemented in the R / G.O.S.ARS (Norwegian).
Multi-beam echo-sounder for sea bottom mapping	SIMRAD EM710	Norway	Nippon Kaiyo Co., Ltd.	An equivalent product suitable for exploration up to 1 500m is not made in Japan. Other foreign brands (SeaBeam, SeaBat, etc..) Are to be considered as equivalent. For foreign vessels, implemented in the R / V Urania NAVE (Italy), Ramon Margalef (Spain).
Transmit synchronization device	SIMRAD K-Sync	Ditto	Ditto	It is a product for coordinated synchronizing of ADCP, EK60, ME70, SX90, EM710. If ME70, SX90, EM710 are used, it is possible that the acquisition of a dedicated device of synchronization program becomes necessary.
Fishing net monitoring system	Scanmar ScanBas	Norway	Nippon Kaiyo Co., Ltd.	An equivalent product is not manufactured in Japan.

Plankton sizing analysis and quantification system	Fluid Imaging Technologies FlowCam	USA	Nippon Kaiyo Co., Ltd.	An equivalent product is not manufactured in Japan.
Fluorimeter	Turner Designs 10AU Field Fluorometer	Ditto	Ditto	An equivalent product is not manufactured in Japan.
Apparatus for measuring particle size distribution by X-ray transmission	Micromeritics SediGraph 5100	USA	Micromeritics Japan	An equivalent product is not manufactured in Japan.
Mooring type current meter	Aanderaa RCM 11	Norway	YSI Nanotech	An equivalent product is not manufactured in Japan.

It is also clear that these products (brands and models, the scanning sonar is SIMRAD SX90) mentioned in the left column are equipment requested by the INRH during the first field work in Morocco.

4.3.2 Japanese Products

Fisheries research vessels built in Japan incorporate a wide range of products and systems taking advantage of scientific and technological excellence in the country. These products and systems concern:

(1) Shipbuilding technology for ensuring a 10-knot speed acoustic survey by the diesel engine propulsion

While many Japanese fisheries research vessels are of diesel propulsion (transmission of the driving force: main engine -> gear -> propeller), most of those built since 1995 in Western countries have retained the electric motor drive (main electric engine -> generator -> control panel (control by inverter) -> propulsion engine -> propeller). Electric motor propulsion has certainly the advantage of controlling and reducing underwater noise, but its propulsive efficiency is lower than that of diesel propulsion resulting in a higher cost of construction and maintenance. Moreover, the electric propulsion involves the knowledge of new equipment such control by inverter and motor drive, as well as training in methods of use of these devices.

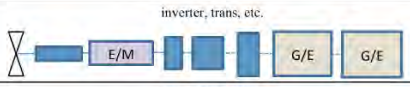
As an indication, an approximate calculation for the comparison of construction and maintenance costs between propulsion diesel engine and electric one is shown in the table below (calculated on the basis of buildings of similar size to that of the Project). According to this calculation, electric propulsion is more expensive, every in construction costs (about 50 million yen), in annual maintenance cost (about 0.5 million yen), and annual operating cost (about 5.5 million yen).

Given almost all the fishery research and training vessels commissioned in Morocco were built within the framework of non-reimbursable assistance from Japan, the crew members such as navigation officers and mechanics adapt to the technical specifications of the hull structure, engine and other equipment of the vessel. Consequently, it is also advisable to retain the diesel engine propulsion on the new fisheries research vessel, especially since it was confirmed during the first field-work in Morocco, that the Moroccan side also wishes to adopt this propulsion system.

Remembering that the technology allowing to limit the underwater noise level to less regulatory values of ICES[*6-1] in diesel engine propulsion (at acoustic survey speed of 10 knots) represents a particular global system of Japan that focuses not only on the propulsion circuit, since the main engine up to the propeller, but also on the hull structure around the machines room. The related details are shown below.

Table 4-4：Comparison between diesel engine propulsion and electric motor propulsion

A. General comparison

	Diesel engine propulsion	Electric motor propulsion
General Idea of propulsion system		
Transmission Coefficient	○ (abt. 0.95) Transmission loss(from M/E to Propeller) 5 % (stern tube, shaft bearing, reduction gear)	△ (abt. 0.75-0.80) Transmission loss(from E/M to Propeller) 3 % E/Motor efficiency loss 5-7 % Inverter, etc. efficiency loss 6-8 % Electric generator efficiency loss 6-7 % Total loss 20-25 %
Construction Cost	○	△ (additional cost for inverter, elecyric motor, etc.)
Operating Cost	○	△ (More fuel consumption needed because of low transmission coefficient as shown in the above)
Maintenance Cost	○	△ (additional cost for inverter, elecyric motor, etc.)

(NB) R/G: Inverter, E/M: Propulsion electric motor, G/E: Generator.

B. Comparison of construction and maintenance costs

(in thousands yen)

SYSTEM	(a) Diesel Engine Propulsion			(b) Electric Motor Propulsion		
	Specification	Equipment Cost	Maintenance Cost	Specification	Equipment Cost	Maintenance Cost
Main Engine	1,471kW(2,000PS) x 750min^{-1} x 1 set	122,000	2,440	Nil	0	0
Reduction Gear	MGR3644V	30,000	300	MGN1824BV	16,000	160
Propeller	4 blades, CPP Diameter 2,700mm	29,000	580	4 blades, FPP Diameter 2,700mm	15,000	150
Generator Sets	400kW(545PS) 360kWe(450kVA) x 2 sets	66,500	1,330	530kW(720PS) 480kWe(600kVA) x 4 sets	140,000	2,800
Control for Electric Motor	Nil	0	0	1,250kW Inverter control board	64,200	1,284
Electric Motor	Nil	0	0	1,250kW x 900min^{-1} 400V	36,700	734
Main Switchboard	for 2 sets of Generator	14,000	0	for 4 sets of Generator 1 set of Electric Motor with transformer, etc.	40,800	0
TOTAL		261,500	4,650		312,700	5,128
				(b) - (a)	51,200	478

(NB) Maintenance cost is that one per year.

C. Comparison of operating cost

System				(a)Diesel engine propulsion		(b) Electric motor propulsion	
【Autumn: 80 days】	Speed	Hours	Days	F.O. (kL)	L.O. (kL)	F.O. (kL)	L.O. (kL)
Navigation (10% SM)	12 knots	350	14.6	95.6	0.45	106.8	0.52
Acoustic (15% SM)	10 knots	684	28.5	117.6	0.54	125.2	0.60
Trawling	3-5 knots	500	20.8	309.1	1.43	332.5	1.61
Observation at fixed points	Stop	381	15.9	69.6	0.34	74.7	0.36
	Total	1,915	79.8	591.9	2.76	639.2	3.09
【Spring: 71 days】	Speed	Hours	Days	F.O. (kL)	L.O. (kL)	F.O. (kL)	L.O. (kL)
Navigation (10% SM)	12 knots	173	7.2	47.2	0.22	52.8	0.26
Acoustic (15% SM)	10 knots	489	20.4	84.1	0.39	89.5	0.43
Trawling	3-5 knots	597	24.8	369.0	1.69	397.0	1.91
Observation at fixed points	Stop	451	18.7	82.4	0.40	88.4	0.43
	Total	1,710	71.1	582.7	2.70	627.7	3.03
【During stop at ports】			Days	F.O. (kL)	L.O. (kL)	F.O. (kL)	L.O. (kL)
Generator			214.0	256.8	0.006	256.8	0.006
Annual consumption (kL)				1,431.4	5.47	1,523.7	6.13
Unit price (¥/kL)				58,520	198,000	58,520	198,000
Annual cost (¥1,000)				83,766	1,083	89,167	1,213
Total Cost (¥1,000)					84,849		90,380
(Note) Calculated at exchange rate of 1 DH = ¥8.8							

i) Measures on geometry of hull and propeller

To eliminate the effects of noise on acoustic equipment mounted to the hull, the geometry of the bow (including bulbous bow) is a form of reducing to the extent possible the production of bubbles, and the geometry of all hull will be designed so that the bubbles products flow to the stern without reaching the equipment. In addition, measures will be taken to ensure uniform distribution of turbulence around the propeller, and to reduce the phenomenon of cavitation from the propeller, in other words the underwater radiated noise and the excitation of the vibrations caused by the propeller.

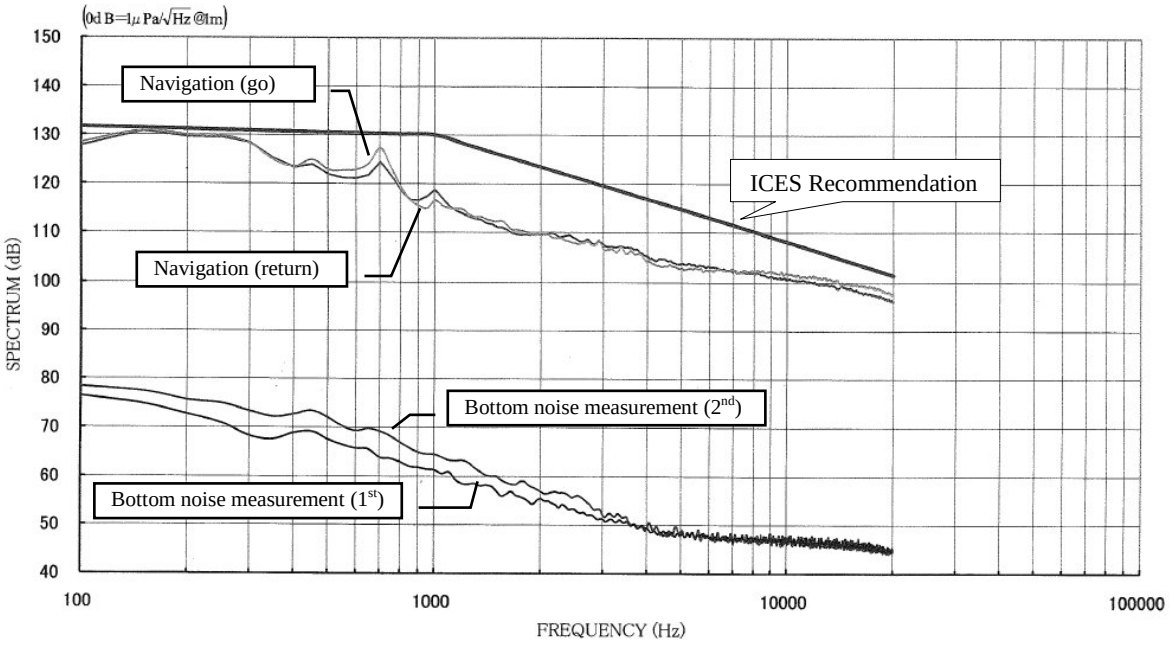
ii) Measures against noise and vibrations

Main engine and reduction gear will be soundproofing measures, and will be equipped with anti-vibration supports at single stage, generators machines are to be installed on the supports with double floor. Moreover the anti vibration support also concern the main equipment inside the machinery, such as air compressors and for main air conditioner. In addition, the vibration absorbing materials will be developed especially in engine room, engine control room, workshop maintenance, space sonar room, air conditioning, thereby reducing the radiated noise underwater

iii) Reduction gear with slipping function

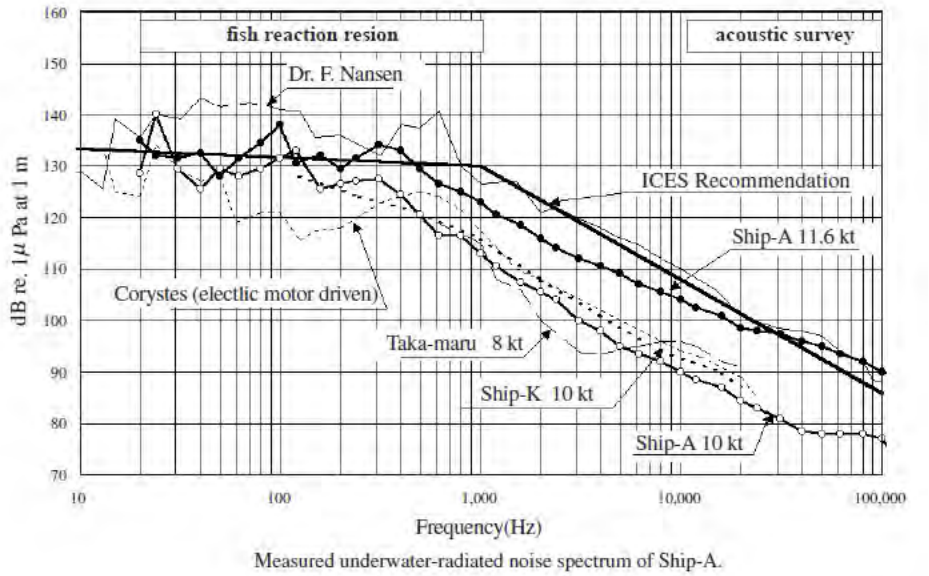
Given that the rotational speed of the propeller is smaller, the cavitation occurs more easily so that it reduces the level of radiated noise in the water, the driving clutch will be provided with a slip mechanism (slip) capable of regulating the speed to the limits of 57 to 173^{min-1}. This device is operable to slide the hydraulic clutch by electronic control so as to regulate the speed of rotation of the propeller to slow speed, worldwide unique technology developed in Japan.

The following figures respectively show the results of measurement of radiated noise of underwater R/V "Yoko Maru" in propulsion diesel engine and "Ship-A" respectively. One and the other do not exceed the values recommended by ICES for the most part, where the Ship-A is the R/V "AMA".



Recommended values by the CIEM on the level of underwater noise: (130 - 22log (frequency (Hz)/1 000): (1 000 < frequency <100 000))

Figure 4-1: Results of measurement of noise radiated underwater by R/V "Yoko Maru"



Measured underwater-radiated noise spectrum of Ship-A.

Source: Journal of the Marine Acoustics Society of Japan (Bulletin de la Société japonaise de l'Acoustique Marine), 31 (3) : 11-19

Figure 4-2: Results of measurement of noise radiated underwater: Ship-A

(2) Auto-tension winch system

The INRH does not have enough staff who masters the techniques of semi-pelagic trawling and unable to continue sampling activities through existing vessels. The auto-tension winch system is to first ask the operator to enter a target depth of shoal focused on the control panel of the trawl attached winch, and then let the winch spun and turn automatically the warps so as to allow guiding the thread and the opening to the target depth. A comparison of features and implemented made about this kind of auto-tension winch system (foreign and Japanese brands) is shown in the table below.

Table 4-5: Comparison of auto-tension winch systems

Foreign brand	Foreign brand (note)	Japanese brand
Winch control panel	Length of spun warps controlled by digital controls on this panel	Same + automatic + turn spinning and automatic control of the trawl winch
Device for monitoring the dynamic behavior of the fishing gear	No	Yes
Instrument for measuring geometric gear	Yes	Yes
Example of installations	Foreign Research Vessels (Unknown details)	Nannsei Maru, Hokko Maru, Yoko Maru, Koyo Maru, Kagoshima Maru
Test results	○	◎(recommended)

(Note) MARELAC (Belgique), SCANTRAWL (Danemark) etc.

(3) Anti rolling system (when stopping for observations at fixed points)

This system is of anti-rolling tank equipped with variable frequency, which have been equipped on R/V "Syunyo Maru", R/V "Hokko Maru", R/V "Yoko Maru" etc. Especially, it is effective for reducing the rolling angle of the hull to about 50% on the sea off the vessel to make observations at fixed points. This tank allows anti-rolling effect of reducing the rolling of the vessel in accordance with a wide range of variations in rolling frequencies, responding to control automatically the frequency of movement of the water in the tank through opening / closing of the damper.

It was found during the first field work in Morocco that Atlantic coast is dominated by the northeast wind, and the survey transect is done right in the direction of the prevailing wind so that the vessel is prone to roll, the R/V "AMA" fails to navigate to the Beaufort scale 5 or 6 (wind speed from 8.0 to 13.8 m/s), the R/V "CAI ", meanwhile, renounces departure at the Beaufort scale 7 (13.9 to 17.1 m/s), and the rolling angle in rough seas varies from 15 to 20 degrees. As a result, this system

will result in securing work in rough seas and the improvement in accurate survey, as well as the decrease of days off due to the bad weather.

(4) Dynamic Positioning System

It is required of a modern fisheries research vessel to provide a high level of performance, particularly in dynamic positioning during observations using CTD, cruising at a very slow speed but constant for a long-term investigations through different objects being towed, tracing location, automatic spinning along the transects. To this end, the project vessel will be provided with a dynamic positioning system suitable for a diverse range of movements: forward / backward, turn left / right, turn on the spot, and translation of the vessel by means of the integrated control of steering gear at high lift, the variable pitch propeller and bow thruster. This system has a wide range of features: maneuver the vessel to the broomstick, holding automatic azimuth thruster, automatic maintenance of vessel speed, automatic maintenance of azimuth thruster and of the vessel speed, automatic reset to the fixed points, and the automatic tracking.

(5) PBCF System (Propeller Boss Cap Fins)

It is a fins unit extending the propeller hub to remove originating eddies, which not only provide energy saving effect of about 5%, but also help reduce the level of underwater noise. Developed in Japan, this system has already been installed on more than 2,000 vessels worldwide and patented in 12 countries. The figure below illustrates the propeller wash with or without PBCF equipment and an example of this system.

Without PBCF

With PBCF

Example of PBCF system equipment

Figure 4-3 : PBCF

(6) Management system of spare parts

Developed in Japan, it equips a new generation of the Japanese fleet. This system allows management of input and output parts in store, control of storage areas, and establishment of invoices and purchase statements, so maintain equipment performance and streamline maintenance operations and management.

(7) LAN system onboard

It is not related to a conventional LAN system onboard that equips the foreign vessels, but, of a real data network whose architecture is built around the powerful servers that interconnect various

navigation instruments, observation equipment, terminals, PCs, printers, external data interface and other telecomputing components, and that is indeed the art state in terms of technological developments to date. In addition, this system is part of an integrated data network to communicate not only with terminals within the vessel but with data systems outside.

4.4 Procurement plan

Taking into account the plans of construction and acquisition of goods described above, the procurement plan in the Project is as follows:

(1) Procedure of invitation to tender

It is estimated that the shipyards cable of constructing the new research vessel that is to be acquired as a part of the Project are of a 6 companies in Japan, and some foreign countries. Consequently, generally speaking, the procurement plan will be through the International Competitive Bidding (ICB). On the other hand, given the fact that the fisheries research vessel that is to be acquired is the one with propulsion diesel engine, from 800 to 1100 tons, it seems indispensable from the technical point of view for the bidding manufacturers to have, at least, one experience in building research vessels of similar size achieved during the last 10 or 20 years. Therefore, the Project will call upon the pre-qualification (P / Q), to conduct a prequalification of bidders with technical capabilities and achievements of construction. The condition of P / Q (draft) under the Project should be prepared based on the JICA's Standard Prequalification Documents under Japanese ODA Loan, so as to be considered that at least 3 firms are eligible to participate to the tender. From a technical standpoint, the bidder should have the shipbuilding experience of research vessels with the following requirements:

i) Have an international gross tonnage of more than 750tons;
ii) To be propelled by a diesel engine during acoustic research;
iii) Have a level of underwater noise below the standards of ICES for a speed of 10 knots (Acoustic Research);
iv) Cruise (85% power), having a noise level in the cabin that meets the criteria set by IMO Res. A468 (VII). Having a vibration level in accordance with ISO standard 6954:2000;
v) Be equipped with a back trawl with a slipway;
vi) To be equipped with two decks

However, when it comes to the achievement of constructing a research vessel that satsifies its conditions during the last 20 years, the Japanese shipyards that perform an overwhelming preponderance at the expense of foreign manufacturers (one single realized unit). Thus, It is desirable that this project is implemented in the form of Special Terms of Economic Partnership (STEP), in this case, the procedure of the tender will be a restricted tender to competition which invites only the Japanese shipyards allowed to submit a bid.

(2) Packaging

Objects of acquisition provided in this project are classified broadly into five categories: 1) construction of the fisheries research vessel, 2) purchase and installation of survey equipemt, 3) transportation of research vessel, 4) training of officers and crew members, and 5) consulting services. Among them, the works of 1) to 4) will be acquired by a fixed price tender related to the shipyards, for the reasons listed below.

i) The fact that the survey equipment imply the implementation and setting the body of the research vessel, it is necessary to ensure the compatibility with electrical and water installation in the vessel approrpriately and effectively, and provide spaces required for its placement and workspaces wide enough. The acquisition of this survey equipment in separate lots would complicatethe coordination between the shipyard and the manufacturers of this equipment, and will often cause delays or doing the same work.
ii) The acoustic survey of equipment require the establishment of the oscillators for transmitting and receiving sound waves to / from the hull, as well as their connection and the adjustment with

equipment bodies installed in the vessel. In the event that a problem would arise due to the reduction of radiated noise under water within the limits recommended by ICES, it would be more difficult to clearly define the share of responsibilities.

iii) The trawling gear that is to be acquired within the framework of the Project being improved type, there must be a series of experiments in reduced model at a circulating pool of water of the considered engine's manufacturer. It should also be noted that the detailed specifications of trawling nets determine those machines to equip the body of the ship such as hydraulic winches. Whence the need to acquire these trawling gears also within the framework of the fixed price tender in block with the vessel's body.

iv) As far as the the reserahc vessel transportation to Morocco is concerned, two options are possible: cases of transport performed by the shipyard, or cases of transport by a shipping company specialized in the delivery of vessels. Transport undertaken directly by the shipyard has some merits, such as ability to perform, on this occasion, the training and coaching for the Moroccan crew on board and the insurance premium during transport is more advantageous in case of the contract with the shipyard in terms of confidence.

v) The fact that the professional training of officers and other members of the crew (guidance on operation of each system equipped to the vessel) as well as initial guidance on the use of survey equipment after delivery to Morocco will be performed by the shipyard staff that will have realized the vessel, the related expenditures will bet the cost of construction. As for navigation and fishing technology, engine operation and maintenance and data collection and sampling using the survey equipment, the Yen-loan attached technical assistance will be provided by JICA (grant).

To summarize, packages of call for tenders will consist of two groups: i) construction and transport of the research vessel (including purchase and installation of survey equipment, professional training of officers and crew of the research vessel, and ii) consulting services. Moreover, the participation of Moroccan personalities in ceremonies (work start ones, impoundment, delivery etc.), As well as sending Moroccan supervisors of construction shall be provided, depending on needs, by the care of the Moroccan government.

4.5 Project implementation schedule

4.5.1 Prerequisites

In case of implementing the present Project with a Japanese ODA loan, delivery and selection procedures will be implemented in accordance with the JICA's "Guideline for the Employment of Consultants under Japanese ODA Loan" and "Guideline for Procurement under Japanese ODA Loan". As well, it is indispensable to use the JICA standard tender documents.

(1) Selection of consultant

The projected fisheries research Vessel requires a high level of technical design and construction. Consequently, the employment of a consultant is indispensable to support the implementing agency and whose main tasks consist of preparing tender documents (basic plans, specifications, estimate of the construction cost in particular), technical evaluation, price evaluation, contract negotiation with successful bidder, the approval of construction plans, and the supervision of construction.

In the case where the Loan Agreement (L/A) would be concluded in March 2014, the selection and signing of the contract is approximately 2 years later in case of project "General untied", In case of STEP (Special Terms of Economic Partnership) loan, the use of consultants is calculated by dividing benefits partly related to the preparation of tender documents and the part about the tender assistance and construction supervision. Since the preparation of tender documents has been the subject of the aid (non-refundable) of JICA, selection of the consultant in charge of this aspect is possible after the formal request for loan was made after pledge by the Government of Japan, and usually requires 3 - 4 months (Moreover, the selection of consultants can be done even before conclusion of L/A). On the other hand, the selection of the consultant responsible for the tender assistance and supervision of construction requires about 2 years, but this component can be executed in parallel with the preparation of tender documents.

Therefore, if it is a STEP loan, the overall program advances thanks to the implementation of the said preparation of documents.

(2) Detailed design and preparation of tender documents

On the basis of consultations and deliberations with the implementing agency regarding the Project design, the consultant will undertake the detailed design, so as to establish basic plans (including general layout plan) and technical specifications to be attached to tender documents, for approval of the implementing agency. In addition, the consultant will support its mission to establish the project's advertising PQ (pre-qualification) and its evaluation criteria developed by the implementing agency, as well as necessary records to such an invitation to Bidders, instructions to Bidders, tender assessment methods, general and special conditions of the contract.

The time required for these tasks requires 6 months from signing the consultant's contract. In addition, the approval period of JICA in different phases related to the tender requests 1-2 months.

(3) Tendering

As indicated in the section "4.4 Procurement Plan", the acquisition of new fisheries research vessel will require performing the pre-qualification (P / Q). The deadline allocated to PQ announcement, the submission of tenders, evaluation and negotiation on procurement up to signing of contract, is assumed to be maximum 18 months for both projects "General untied " and "STEP, considering the fact that it took 14 months in the past yen-loan project in Morocco. During this period, it is necessary to obatain approval of JICA on 6 steps such as"PQ documents and evaluation criteria", "Results of PQ evaluation", "Tender documents and evaluation criteria", "Results of tender evaluation (technical)", "Results of tender evaluation (price)", and "contents of contract".

(4) Approval of technical drawings and shipbuilding

The time allowed for the preparation and approval of implementation plans of the shipyard, keel-laying, launching, test operation (including sea trial) and completion of the work (delivery at the shipyard) will be 25 months.

(5) Transport and delivery to the site in Morocco

The project vessel, after completion and delivery, will be transported from country of origin to Morocco under Moroccan flag. During the transport, which will be conducted by a shipbuilder (or navigation agent) under the contarct of construction, the on-the-job training (OJT) will be carried out to the Moroccan crew. In case of construction in Asia, shipping to Casablanca, even if via the Suez Canal, still takes two months, given the ship escort operations performed as part of the fight against Somalia coast piracy.

(6) Trainings on the use of survey equipment

After delivery to the owner of the vessel in Morocco, training on the use of survey equipment, such as scientific echo-sounder and sonar with echo-integration system, multi-beam echo sounder for sea bottom mapping, CTD system, acoustic doppler current profiler (ADCP) with ultrasound will be held for researchers of INRH onboard. Furthermore, the INRH, the operation and implementing agency of the Vessel (owner) will make necessary arrangements for registration of the Vessel to Direction of Marine Marchande (acquirement of ship flag), ship insurance, and so on.

4.5.2 Project implementation program

When the Moroccan Government presents its loan query to the JICA in April 2013, the schedule until the conclusion of the loan agreement is planned as follows:

- Request for loan : April 2013
- Appraisal by JICA : October 2013
- Commitment of the Government of Japan : December 2013
- Signing of Exchange of Notes (E/N) : February 2014
- Conclusion of the Loan Agreement : March 2014

(1) In case of "General untied" project

Taking into account the facts of the past yen-loan projects in Morocco, there must be a period of maximum 2 years from the signing of the Loan Agreement (L/A) to the selection of loan consultant to prepare tender documents. The program of implementation is planned as shown in Figure 4-4.

- Contract of Consultant : March 2016
- PQ announcement for shipbuilders : November 2016
- Tendering : May 2017
- Shipyard contract : May 2018
- Approval of plans & Construction : May 2018 to May 2020
- Delivery (at shipyard) : June 2020
- Delivery to Morocco : August 2020

(2) In case of STEP project

In case of the STEP project, the Moroccan party can benefit from free detailed design (the establishment of the tender documents) of JICA. The consultant in charge of this operation will be selected by JICA and will conclude the contract with JICA. However, it is assumed that it takes maximum 2 years from the signing of L/A to the contract of loan consultant (for tender assiatance and construction supervision) even in STEP project. As the detailed design will be made during the selection of the loan consultant by the Moroccan government, the overall schedule can be reduced by approx. 7 months compared to the General untied project. In this case, the timing of implementation is provided as shown in Figure 4-5.

- Contract of Consultant (for D/D) : May 2014
- Contarct of Loan Consultant : March 2016
- PQ annoucement for shipbuilders : April 2016
- Tendering : October 2016
- Shipyard Contract : October 2017
- Approval of plans & Construction : October 2017 to October 2019
- Delivery (at shipyard) : November 2019
- Delivery in Morocco : January 2020

In both cases of general untied and STEP, it is possible to execute PQ and tender at same time, to reduce the period about 6 months from the above schedule in this case.

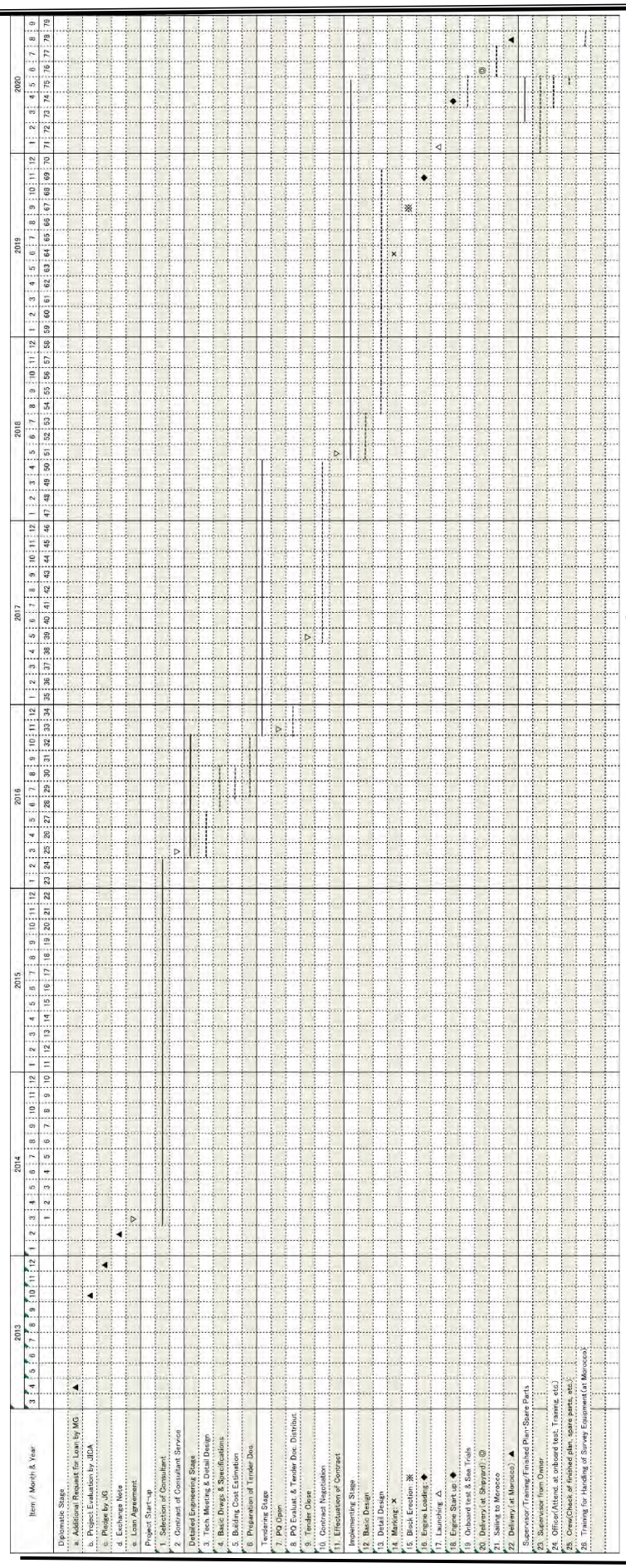


Figure 4-4: Project implementation schedule (In case of General untied project)

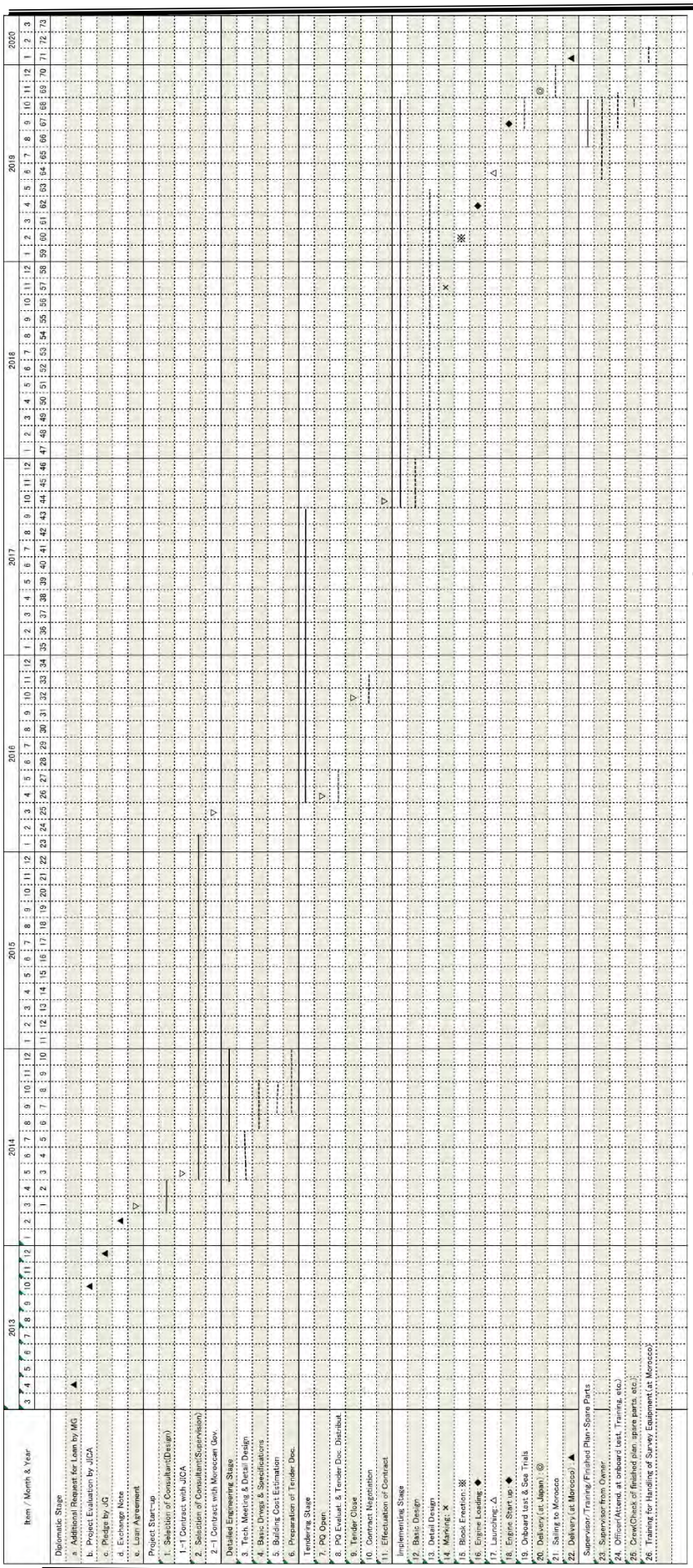


Figure 4-5: Project implementation schedule (In case of STEP project)

4.6 Consultants' services

4.6.1 Need for consultants' services

To carry out the operations of the Project implementation, it is essential to employ consultants with sufficient experience at projects similar to the present Project. The use of consultants will enable DPM and INRH to benefit from numerous counsels at both technical and administrative levels, so as to conduct the Project as scheduled and according to the budgets.

The Moroccan implementing agency will proceed to the selection and assignment of consultants, in accordance with JICA's "Guideline for the Employment of Consultants under Japanese ODA Loan". Moreover, if this Project is implemented within the framework of the STEP project, the consultant responsible for the detailed design will be possible to be employed and be made available free of charge under the care of JICA (Linkage D / D: partnership in detailed design study).

4.6.2 Consistency of consultants' services

Here is the consistency of the work to be provided by the consultants:

Table 4-6: Main Works of Consultants

Consulting Service	Consultant for STEP project		Consultant for General untied project
	Linkage D/D	Loan	Loan
1) Re-confirmation of design conditions	○		○
2) Besic design of the projected Vessel	○		○
3) Preparation and advice on conditions and criteria of pre-qualification (P / Q)	○		○
4) Preparation of tender documents (including specifications and general lay out)	○		○
5) Preparation of the detailed estimation of the vessel's price and the construction schedule (approximate)	○		○
6) Counsel during the P/Q and call for tender		○	○
7) Technical advice during signing contracts of construction		○	○
8) Review and advice on approval of the implementation plan of construction works		○	○
9) Assistance to various functional tests at the workshop of manufacturers and at the shipyard		○	○
10) Supervising the execution of construction works		○	○
11) Technical advice on testing at sea, transport and training		○	○

4.6.3 Staffing

As described above, any fisheries research vessel is a ship that requires a high level of technical design and construction. It is therefore essential to provide the experienced consultants with specialized skills in each area, and especially the staff described below.

1) Project Manager:

Conducting and supervising all works related to the Project including management of the work of team members in the various phases. Assiting in ensuring cooperation and coordination with JICA and the government agencies of the partner party (MEF, DPM and INRH).

Qualifications:

A professional good experience in fisheries development projects in foreign countries is highly

required (and especially those related to acquisition of the vessel and supply of goods). It is better to have a professional experience in Morocco.

2) Assistant Project Manager:

Assisting theProject Manager, and ensuring, as a specialist in tenders and bids, assiting in the preparation of pre-qualification documents, advertising of these, the assessment of potential bidders, newsroom management of tender documents and assessing the tender's results.

Qualifications:

A professional good experience in terms of acquiring vessels and provision of supplies and commodities in ODA loan projects or by non-reimbursable financial aid is highly required. It is better to have a professional experience in Morocco.

3) Naval Architect and Manager of Design Team:

Ensuring all tasks of general management with a technical nature, such as design : quantity surveying of the projected vessel, development of technical specifications, technical assessment of the tenders' results, reviewing and approving plans submitted by the shipyard, and supervising the construction works.

Qualifications:

A good and professional experience in terms of designing and building fisheries research vessels of a gross tonnage exceeding 500 tons is highly required. It is better to have a professional experience in Morocco.

4) Hull Structure and Fitting Design :

Ensuring the design and quantity surveying of the hull's basic structure, hull's accessories (Deck's equipment, laying out premises), development of technical specifications, reviewing plans prepared by the shipyard, and supervising the construction works.

Qualifications :

i) A professional experience in designing the hulls of vessels with a gross tonnage that is equal or exceeding 500 tons and that performs international navigations is highly required (in fact, the rules applied to the ship building change on the threshold of500 gross tonnage, and these rules are also different depending on whether the building is used for international navigation or non-international).
ii) A professional experience in terms of designing stern trawling hulls is highly required (because it is necessary to be informed of trawling and design accessories of trawlers 'hulls).
iii) A professional experience in terms of designing the fisheries research vessels' hulls is highly required (because it is necessary to carry out the design to reduce the level of underwater noise that affects fishing echosounders).
iv) A professional experience at designing hulls of vessels with anti-roll action to reduce roll of about 50% (because it is necessary to ensure the safety of personnel and the safety of equipment during oceanographic observations without anchor).

5) Machinery Fitting Design:

Ensuring the lay out of the engine compartment, the basic design and quantity surveying on machines' equipment (main and auxiliary engines, thrusters), the development of technical specifications, reviewing drawings prepared by the shipyard as well as the equipment procurement and supervision of installations.

Qualifications:

A professional experience on designing the fisheries research vessels' machines is highly

required (because it is necessary to perform the design to reduce the level of underwater noise that affects the scientific echosounders).

6) Electric Fitting Design :

Ensuring the implementation of the engine compartment, the basic design and quantity surveying on equipment of electrical installations (distribution panels, equipment of navigation and radio communications), the development of technical specifications, reviewing plans established by the shipyard, and the purchase of electrical and supervision of installation operations.

Qualifications:

A professional experience on designing hulls of vessels with a gross tonnage equal or exceeding 500 tons and that performs international navigation is highly required (in fact, in fact, the rules applied to the ship building change on the threshold of 500 gross tonnage, and these rules are also different depending on whether the building is used for international navigation or non-international). Moreover, an experience at designing and building LAN system on board of the vessel is required.

7) Fishing Gear and Fishing Machinery Design:

Ensuring the basic design of the warp winches, of nets and trawl fishing gear etc, the supervision of procurements and installations, assistance and monitoring of fishing tests.

Qualifications:

An experience at trawl winches' designing and their related equipment is required or an experience at fishing with semiplagic/or bottom trawl, or an experience at fishing with stern trawl.

8) Survey Equipment:

Ensuring the development of technical specifications for the equipment of acoustic survey, oceanographic observation, sampling and analysis, evaluation of selected materials, supervising the operations of purchase and installation, assisting and supervising tests at sea.

Qualifications:

An experience at designing fisheries research equipment and oceanographic survey is required, or an experience at handling this kind of equipment.

4.6.4 Workforce (person-month)

The schedule of the consultants' tasks prepared on the basis of "Project implementation schedule" of figures 4-4 and 4-5 is shown in Annex 5-1. Moreover, the workforces (person-month) required for the consultants' services are estimated as indicated in the table below.

Table 4-7: Required workforces (person-month)

Work Stage	Detailed design, preparation of tender documents					PQ annoucement, call for tender, approval of plans, supervision, test operation, delivery					
Assignment	① Intermittent Work	② Coefficient	③ (①x②) Conversion	④ Continuous work	⑤ (③+④) Person-month	⑥ Intermittent work	⑦ Coefficient	⑧ (⑥x⑦) Conversion	⑨ Continuous work	⑩ (⑧+⑨) Person-month	⑤+⑩ Total Person-month
1) Project Manager	0		0	3.50	7.50	0		0	6.00	21.25	28.75
	0		0	4.00		21,00	0,25	5,25	10.00		
2) Asst. Project Manager	0		0	3.50	7.50	0		0	5.00	14.75	22.25
	0		0	4.00		25,00	0,15	3,75	6.00		
3) Naval Architect & Manager of Design Team	0		0	3.50	7.50	0		0	5.00	22.35	29.85
	0		0	4.00		21,00	0,35	7,35	10.00		
4) Hull Structure & Fitting Design	0		0	2.00	6.50	0		0	1,00	11.35	17.85
	0		0	4.50		21,00	0,35	7,35	3,00		
5) Machinery Fitting Design	0		0	1.00	6.50	0		0	0	8.90	15.40
	0		0	5.50		23,00	0,30	6,90	2,00		
6) Electric Fitting Design	0		0	1.00	6.50	0		0	0	8.90	15.40
	0		0	5.50		23,00	0,30	6,90	2,00		
7) Fishing Gear & Fishing Machinery Design	0		0	1,00	2,95	0		0	0	0.90	3.85
	6,50	0,30	1,95	0		3.00	0.30	0.90	0		
8) Survey Equipment	0		0	0	2,25	0		0	0	0.60	2.85
	7,50	0,30	2,25	0		2,00	0,30	0,60	0		

* Upper column: Work in Morocco Lower column: Work in Japan

4.6.5 Fees related to consultants

The table below shows the breakdown of fees related to consultants, that are estimated respectively for the STEP and for the "General untied" project. For more details, refer to Annex 5-2.

Table 4-8: Details of Consulting Fee (in thousands of Yens)

Item	In case of STEP Project		In case of General untied	
	Detailed design, tender documents	PQ announcement, tendering, construction contract, approval of plans, supervision, testing operation, delivery	Detailed design, tender documents	PQ announcement, tendering, construction contract, approval of plans, supervision, testing operation, delivery
Staff expenses	(120,927)	228,018	120,927	228,018
Travel expenses (in Morocco)	(7,707)	8,712	7,707	8,712
Airfare (Morocco / Europe)	(7,946)	9,412	7,964	25,340
Travel costs (construction supervision)	0	5,130	0	6,480
Travel costs (construction supervision)	0	1,600	0	1,100
Local staff costs	(5,950)	13,345	5,950	13,345
Car rental fees	(1,604)	2,955	1,604	2,955
Document & communication fees	(1,700)	3,130	1,700	3,130
Office rental fees, etc.	(1,563)	1,562	1,563	1,562
Office consumables	(105)	106	105	106
Total	(147,520)	273,970	147,520	290,748
Total general	273,970 (147,520)		438,268	

(NB) The amount shown in the parenthesis is covered by JICA Linkage D/D.

It is stated that the estimate was made assuming construction in Japan in case of the STEP project and construction in Europe in case of " General Untied" project (see 5.1.2-(3) below).

Chapter 5 Project Cost

5.1 Project Cost

5.1.1 Calculations terms

The elements of the Project cost will be composed as follow:

i) Research Vessel
   - Construction cost (Manufacturing cost) (including the cost of supply and installation of research equipment)
   - Cost of transportation (including expenses related to the fuel on transport insurance and delivery etc.)
   - Expenses related to training of officers and crew
   - Expenses related to training on use of survey equipment after delivery
ii) Consulting fee
iii) Price escalation contingency
iv) Physical contingency
v) Interest during construction
vi) Commitment charge

Moreover, given that the projected vessel will be designed and built as a vessel that performs international navigation, the value added tax (VAT) at a rate of 20% is generally exempt. The import duty (2.5%) is also exempted in case of goods which value is over 100 million or 200 million DH (amount under being reconfirmed by INRH, see section 9.2.5). The VAT (5%) in Japan imposed to the Japanese shipbuilder is exempted since the Vessel is exported. However, as for sub-contracts regarding goods and services procured from sub-contractors by the shipbuilder, the VAT is included but it can be reimbursed later.

The following expenses are not included in the composition of the Project cost.

i) Expenses related to obtaining all permits and approvals necessary for the possession of the vessel of the Project in Morocco, and those necessary for the implementation of this project in its territory.
ii) Expenditures for customs clearance of all equipment and materials including the vessel to deliver to Morocco related to the Project, as well as reporting formalities of entry and pilotage services, etc.
iii) Expenses related to inspections required during construction or upon completion of the vessel of the Project in the presence of competent persons, including inspectors of the Moroccan Department of Maritime Affairs, etc.
iv) Expenses related to the payment of insurance premiums subscribed for the vessel's hull and its equipment and materials after arrival in Morocco.
v) Expenses related to the visit of Moroccan personalities to Japan (work start ceremonies, impoundment, delivery, etc.) as well as the expenses related to the Moroccan people coming to Japan for supervising construction works as well as their stay

5.1.2 Project cost

(1) In case of construction in Japan

The approximate cost of the respective Project "Plan A" and "Plan B" is shown in the following summary table.

Table 5-1: Estimated cost of the Project (Construction in Japan) (In thousands yen)

	Plan-A	Plan-B
1. Research Vessel	**5,233,900**	**4,429,300**
①Construction cost (Manufacturing cost)	4,438,900	3,663,400
②Design and technical fee	361,500	361,500
③General expense	288,900	269,100
④Other expenses (construction insurance, test operation, and administration costs)	26,800	22,200
⑤Transportation cost of vessel	97,800	93,100
⑥Training of officers and crew	13,400	13,400
⑦Training on use of survey equipment (in Morocco)	6,600	6,600
2. Consulting Fee	**421,500**	**421,500**
①Detailed design)	147,500	147,500
②Tender assistance & supervision of construction)	274,000	274,000
Total (1+2+3)	5,655,400	4,850,800

(Note) VAT, price escalation contingency and physical contingency are not included in this table.

For details of construction cost, see Annex 6-1.

(2) In case of construction in a third country

The cost of construction when building in a European shipyard was calculated approximately. Taking into account the cost of labor, the price of steel materials, and the cost of equipment (survey equipment imported as SIMRAD).

1) Cost of labor

The table below shows the normalized data based on U.S. = 100. Converting the amounts of wages (in manufacturing) in U.S. dollars at the exchange rate of each year. It is true that until the year 2009, personnel costs in European countries (except Spain) were higher than in Japan. However, a correction with the Euro by a current exchange rate of 106.46 = 1 euro (exchange rate of JICA in December 2012) would provide:

Europe / Japan = (119.6/90.6) × (106.46/130.35) = 1.078 : (Rates corrected in 2009)
(116.0/84.7) × (106.46/142.06) = 1.026 : (Corrected by the average)

Thus it is considered that the cost of labor in this sector is the same in Japan and Europe.

Table 5-2: Hourly wage of production workers (manufacturing)

Unit：As USA=100

	2003	2004	2005	2006	2007	2008	2009	Average	
Japan	84,2	88,4	86,0	81,1	76,1	86,3	90,6	84,7	
							Europe/Japan =		1,369
U.K.	88,7	105,2	106,2	110,1	117,5	110,9	91,8	104,3	Average of 9 European countries 116,0
Germany	121,1	130,6	128,4	132,4	139,4	149,6	138,7	134,3	
France	99,5	108,6	109,4	113,0	121,1	131,0	119,5	114,6	
Italy	82,6	93,2	93,4	95,8	102,2	111,0	104,3	97,5	
Holland	108,2	117,9	117,2	119,5	126,1	138,8	129,7	122,5	
Sweden	110,9	120,9	119,4	121,8	134,2	136,8	118,9	123,3	
Finland	99,9	112,3	113,4	117,7	125,2	138,6	130,5	119,7	
Norway	129,1	138,8	144,2	151,4	168,3	180,6	160,7	153,3	
Spain	61,7	68,3	69,5	72,5	78,4	85,7	82,7	74,1	
							2009 average	**119,6**	(Europe/Japan =1.321)
Ex. rate(€)	131,03	134,39	138,86	146,05	161,26	152,46	**130,35**	142,06	

Source： U.S.Bureau of Labour Statistics(2011.3) *International Comparison of Hourly Compensation Costs in Manufacuturing, 2009*

2) Price of steel materials

The table on the right shows a recent comparison (March 2011 to June 2012) of the price between Japan and the UE for thick plate and shaped steel (in H). The average price of UE was multiplied by the average exchange rate and compared with the Japan average price. So, by adopting a unit price ratio of 0,99 for the steel bars, we calculated the materials' fees in case of foreign construction.

Table 5-3: Comparison of prices of steel materials

	Thick Plate		Shape Steel		Ex. Rate
Year	EU(€/t)	Japan(¥/t)	EU(€/t)	Japan(¥/t)	(€)
Mar. 2011	715	87,250	715	82,000	114.45
Apr. 2011	713	88,750	685	82,250	120.32
May 2011	700	88,750	681	79,750	115.93
Jun. 2011	707	88,750	686	76,750	115.95
Jul. 2011	700	88,750	677	76,750	113.78
Aug. 2011	700	88,250	677	75,750	110.74
Sep. 2011	676	87,250	682	76,000	106.04
Oct. 2011	624	87,250	677	75,000	105.17
Nov. 2011	619	86,250	669	72,000	105.21
Dec. 2011	611	86,250	654	71,500	102.61
Jan. 2012	607	86,250	669	71,500	99.34
Feb. 2012	635	85,250	680	70,000	103.66
Mar. 2012	638	85,250	680	70,000	108.96
Apr. 2012	644	85,250	682	70,000	107.32
May 2012	634	85,250	674	68,000	101.98
Jun. 2012	622	84,250	662	67,000	99.42
平均	€ 659	86,813	€ 678	74,016	108.18
	1€=	¥108.18			
Unit Price(¥/t)	¥71,291	¥86,813	¥73,346	¥74,016	
EU(€) / Japan(¥)	0.821		0.991		

3) Imported products and survey equipment in particular

Products imported from Western countries dominate in the composition of survey equipment. It is expected that purchase prices in Japan through sales agents are higher 25% than those in Europe or the United States. Therefore, purchases in foreign countries were calculated on the basis of 80% of the purchases price in Japan.

(3) Comparison of construction cost

Given the above, a comparison with the case of construction in foreign countries shown in the table below. Details of some items not mentioned in this table are given in Annex 6-1.

Table 5-4: Comparison of construction cost (In thousands yen)

	Construction in Japan		Construction in Europe	
	Plan A	Plan B	Plan A	Plan B
1. Direct Production Cost	**3,729,000**	**3,131,800**	**3,599,900**	**3,010,600**
(1) Material Cost	379,600	281,900	354,900	265,300
1) Direct material cost	348,500	258,800	324,100	240,400
a. Hull structure part	123,100	92,900	100,900	76,200
b. Hull fitting part	132,700	96,500	131,300	95,500
c. Machinery part	48,400	36,300	47,900	35,900
d. Electric part	44,400	33,100	43,900	32,800
2) Auxiliary material cost	31,100	23,100	30,800	22,900
(2) Equipment Cost	2,562,400	2,249,600	2,458,100	2,147,100
1) Hull part	284,200	204,000	284,200	204,000
2) Machinery part	639,300	510,900	639,300	510,900
3) Electric part	415,100	369,500	415,100	369,500
4) Survey equipment	738,500	699,600	634,200	597,100
5) Fishing equipment	485,400	510,900	485,400	465,600
(3) Labor Cost	618,100	453,600	618,100	453,600
(4) Paiting Man-hour Cost	39,400	35,400	39,400	35,400
(5) Direct Cost	129,500	111,300	129,500	111,300
2. Indirect Production Cost	**709,900**	**531,600**	**709,900**	**531,600**
Construction Cost Total (1+2)	**4,438,900**	**3,663,400**	**4,309,800**	**3,542,300**

(4) Comparison between « General untied » and STEP

Based on the estimated costs calculated in the above paragraphs "(1) Case of construction in Japan" and "(2) Case of construction in a third country," assuming that if the Project is implemented within the framework of the "General untied" loan, the contract would be awarded to a shipyard in European countries, and if it is a STEP loan, the contract would be awarded to a Japanese shipyard, it was proceeded to the comparison of costs at each case, the results are as follows.

Tableau 5-5: Comparison between "General untied" and "STEP" loan

		"General untied"	STEP
Interest rate	Main work	1.4%	0.2%
	Consultant	0.01%	0.01%
Repayment Period (including grace period)		25 years (7 years)	40 years (10 years)
Target for loan		85% of the total project cost (excluding VAT)	100% of the total project cost (excluding VAT)
Rules on country of origin		No	The component of at least 30% of the contract to buy in Japan.
Detailed design and preparation of tender documents		Repayable	Grant (Detailed Design (D/D) in partnership with JICA)
Project duration (From L/A to delivery at site)		6 years 5 months	5 years 10 months
Technical cooperation (Yen-loan attached T/A)		To be defined	Possible to be provided by grant.

Given these conditions, the results of the comparison of total project costs between "General untied" (construction in EU countries) and "STEP" (construction in Japan) are summarized in the table below.

Table 5-6: Comparison between estimated costs of "STEP" and "General untied"

(In million yen)

Item		Plan-A		Plan-B	
		STEP	Untied	STEP	Untied
A.	**Eligible portion for loan**				
1.	Research Vessel ((1)+(2)+(3))	**6,261**	**6,132**	**5,299**	**5,171**
(1)	Base Cost (①+②+③+④+⑤+⑥+⑦)	5,234	5,048	4,429	4,256
	① Construction Cost (Manufacturing Cost)	4,439	4,310	3,663	3,542
	②Design and Technical Fee	361	361	361	361
	③General Expenses	289	283	269	264
	④ Other Expenses (Construction, insurance, test operation, and administration cost)	27	25	22	25
	⑤ Transportation cost of vessel	98	54	93	49
	⑥ Training of officers and crew	13	10	13	10
	⑦ Training on use of survey equipment (in Morocco)	7	5	7	5
(2)	Price Escalation Contingency	729	793	617	669
(3)	Physical Contingency	298	292	252	246
2.	Consulting Fee ((1)+(2)+(3))	**321**	**513**	**321**	**513**
(1)	Base Cost (①+②)	273	438	273	438
	① Detailed Design	0	147	0	147
	② Tender Assistance & Supervision of Construction	273	291	273	291
(2)	Price Escalation Contingency	32	51	32	51
(3)	Physical Contingency	15	21	15	21

	Eligible Portion Total（A）	**6,582**	**6,646**	**5,620**	**5,685**
B.	**Non-eligible portion for loan**				
1.	Administration Cost (A x 5%)	329	332	281	284
2.	Import Duty (Research Vessel Cost x 2.5%): exempted)	(157)	(153)	(132)	(129)
3.	VAT (Research Vessel Cost x 20%: exempted)	(1,252)	(1,226)	(1,060)	(1,034)
	Non-eligible Portion Total (B)	**329**	**332**	**281**	**284**
C.	Interest during construction (2014～2019)	**22**	**171**	**18**	**144**
D.	Commitment charge (un-disbursed loan amount x 0.1%)	**40**	**48**	**34**	**41**
	Total Project Cost (A+B+C+D) (Except taxes and duties)	**6,972**	**7,197**	**5,953**	**6,154**

(Note)
1) If necessary, the expenses related to the visit of the Moroccan people to Japan (keel laying, launching, and delivery ceremonies) as well as expenses related to the arrival of Moroccan supervisors to Japan for monitoring construction works and their stay will be borne by the Moroccan side.
2) Price escalation contingency: Applied the JICA standard rates (2.1% for foreign currency, 0.5% for local currency)
3) Physical contingency: (Base Cost + Price Escalation Contingency) x 5%
4) Consulting fee (for D/D) in case of STEP is not given, as it will be financed by JICA.
5) The import duty will be exempted if the Vessel is constructed in the country or region where Morocco concludes the Free Trade Agreement (FTA). In addition, the goods which value is over 100 million or 200 million DH (amount under being reconfirmed by INRH) will be also exempted from the import duty.
6) VAT (20% of research vessel cost) will be exempted upon necessary procedure by INRH, since the Vessel is designed to operate in the international water.
7) Interest during construction: In case of STEP: Research vessel cost x 0.2%/year, Consulting fee x 0.01%/year
In case of Untied: Research vessel cost x 1.4%/year, Consulting fee x 0.01%/year
8) Interest during construction and commitment charge can be included in the eligible portion for loan, if required by the Moroccan side.
9) Exchange rate (November 2012): 1 DH = 8.8 Yen, US$1 = 78.17 Yen, US$1 = 8.88 DH

As indicated in the table above, total project cost of general untied project is about 200 – 220 million Yen higher than STEP project. It is estimated that both research vessel cost and consulting fee are of 100% foreign currency portion in the Project, so that 100% of eligible portion for loan can be financed by loan regardless STEP or general untied. Therefore, the eligible portion total in the above table will be deemed as the loan amount. Although the loan amounts are almost same between STEP and general untied, due to the difference in loan terms, the total amount of payment by the Moroccan side including the interest is about 710 – 850 million Yen higher in case of general untied than STEP. Thus, the STEP project is significantly advantageous (see table below).

For detail schedules for disbursement and reimbursement are shown in Annex 6-2.

Table 5-7: Comparison of total payment amounts (In million yen)

	Plan A		Plan B	
	STEP	General untied	STEP	General untied
Total project cost (A)	6,972	7,197	5,953	6,154
(Eligible amount for Yen loan (B))	(6,582)	(6,646)	(5,620)	(5,685)
Interest charges (C)	158	769	134	648
Total amount of payment (A+C)	7,130	7,966	6,087	6,802
(Total amount of repayment (B+C))	(6,740)	(7,415)	(5,754)	(6,333)

(NB) See the Annex 6-2 for details.

(5) Result of the above consideration

As a result of the above consideration, it is desirable for Morocco to implement the Project by STEP loan because of the lower cost burden both for Plan A and Plan B.

Chapter 6 Project implementation System

6.1 Implementing Agency and Borrower

In the final meeting at MEF on January 28, 2013, the following 2 options on the project implementation system were proposed by the Moroccan side against those proposed by the Survey Team (as shown in the Draft Final Report). As the background of this proposal, it is recognized that it is important for INRH to be the owner of the Vessel so as to operate and maintain the research vessel, while the borrower of loan will basically be the owner of the Vessel in case of loan project. Given the MEF is the borrower, it is indispensable to ensure the situation that the INRH can use the Vessel as planned, and the Moroccan side is now under examination on its legal possibility. In this context, the implementation system will be finally determined by the Moroccan side after the receipt of this Final Report.

Table 6-1: Options for project implementation system

	Proposal in the DF/R	Proposal by the Moroccan side	
		Option 1	Option 2
Borrower / Reimburser	MEF	INRH	MEF
Implementing agency	DPM	INRH	INRH / DPM
Operation & maintenance agency	INRH	INRH	INRH
Ownership of the Vessel	INRH	INRH	INRH

6.1.1 Borrower

The following two cases are assumed as a form of loan for the Project.

(1) Case where the Government borrows and repays

In this case, the MEF would borrow and repay the loan. It seems advisable that the MEF becomes the borrower to carry out activities related to the loan contract, application and repayment, while the MAPM plays a role as an implementing agency of procurement activities in particular.

(2) Cases where the Government would guarantee and INRH would borrow and would repay

In cases of this kind, the following two sub-cases are assumed.

a) Case where INRH borrowed and the State repays

b) Case where INRH borrowed and INRH repays (by the budget of the INRH)

In favor of the borrower, it will be granted a grace period for repayment of 7 years (10 years in case of "STEP" loan). In the case of (b), INRH would prepare a budget for reimbursement from the budget year following the end of the grace period. In addition, the fiscal measures concerning the reimbursement would be examined before the year in which the actual reimbursement started.

If the State (MEF) would be the borrower, the allocation of matching funds to be prepared by the Moroccan side to a budget of 2013 would be impossible. However, it is possible to allocate this fund as supplementary budget of 2013 for the INRH, if the INRH would be a borrower. It is possible to ensure the supplementary budget for public institutions such as the INRH, with the agreement at the top management (i.e., approval of the board of directors or management).

During the meeting held on November 21, 2012 with the MEF concerning the borrower of this project, the Moroccan party expressed its opinion that the borrower should be INRH. In this regard, the representative of JICA explained that the INRH is certainly an independent organization that receives revenue for its own account, but not one that can ensure operation based on self-sufficiency in the most strictly speaking, it is desirable that the MEF is the borrower, so as to increase the degree of confidence in terms of repayment, and the Moroccan side gave its agreement (see Annex 1-2: Minutes of deliberations during the presentation of interim Report). However, when this matter was

reconfirmed to the Moroccan side on January 28, 2013, it was suggested by the Moroccan side that it is indispensable to make INRH as the Owner of the Vessel so that the Vessel be operated and maintained by INRH, but the Borrower will be the Owner in principle in case of loan project. Thus, in case that MEF will be the Borrower, it is necessary to confirm legally the possibility and procedures to make INRH as the Owner, so that this matter will be finally determined by the Moroccan side after the receipt of the Final Report.

Although it is desirable that the MEF will be the Borrower since INRH has no experience on loan projects, INRH should act as the Borrower in case that it is not possible to make INRH as the Owner within 1 month after delivery. The most important matter is to operate and maintain the Vessel as planned soonest after the delivery. Although INRH has no experience as the Borrower, it can be said that INRH is in the position where is easier to obtain the budget for reimbursement, under the guarantee of the State, comparing with government corporations operated on financially self-sufficient base, because the INRH is an independent organization characterized that the most parts of revenue are from government budget. However, it is necessary to ensure that the government subsidy would be donated for repayment of the loan during next 30 years.

6.1.2 Implementing agency

The implementing agency of the Project will be assumed as 2 cases: 1) INRH only or 2) INRH with the Department of Marine Fisheries (DPM) of the Ministry of Agriculture and Marine Fisheries (MAPM), provided that the INRH and/or DPM is duly authorized for this purpose by the Minister of Economy and Finance, which is the Borrower. If INRH and MEF will execute the Project together, DPM shall obtain loan application process and budget negotiations, as well as activities related to the use of consultants, procurement of goods to be acquired in this project, and the control of workflow, while INRH shall be responsible for all the technical aspects including establishment of technical terms of reference (TOR) of the consultants, validation of the technical specifications of fisheries research vessel and so on. The employed consultants will include, on behalf of INRH and/or DPM, activities in terms of detailed design of the research vessel, preparation of prequalification (PQ) and tender documents, tender assistance and supervision of construction.

Although DPM and INRH does not have past experience in loan projects, there are many experiences in procurement as executing agency for Japan's grant aid projects (See Table 1-4 of the Chapter 1). In particular, INRH has executed the construction of fishery research vessels (1985 and 1999) and construction of fishery products valorization center in Agadir (2001) and central laboratory in Casablanca (2007) individually or in collaboration with DPM. In addition, INRH has the following experience in procurement.

Table 6-2: INRH's experience in procurement under cooperation by other donors

Project	Contract			Donor	Project Amount (MDH)	Period
	Type of Work	Contractor	Amount (MDH)			
Construction of Aquatic Animal Pathological Laboratory in Tanger	Technical study	Plural	1,3	Spanich Agency for International Cooperation (AECID)	25 (of which 5 millions by INRH)	2009-2013
	Construction of structure	SOBAY	10			
	Finishing and carpentary work	MGM	2,6			
	Procurement of scientific equipment	Plural	4,6			
	Training		1			
Repair of R/V.Charif El Idrissi	Supply and installtion of propulsion engine for R/V. CAI inlcuding calibration.	Plural	22,3	European Union (EU)	22.3	2009-2010
Construction of administration building and auditorium	Technical study	Plural	0,6	European Union (EU)	20	2010-2012
	Construction of structure	ATELIER REYAD	8,3			
	Finishing and carpentary work	SENOMAR	7,8			
Fisheries resources survey and	Recruitment of a team of 32 cadres, technicians and clerks	-	20,1	Millenium Challenge	36.7	2010-2013

socio-economic survey on artisanal fisheries in the improved fish landing points.	Office equipement and consumables	-	3,6	Corporation (MCC)		
	Administration charge	-	10			
Artifical Reefs in Martil and Agadir	Technical study	INVIVO	2	Fishery Development Fund	75	2011-2013
	Fabrication & installation of artificial reefs	SOMAGEC	60			
	Control	MDC	4,2			
Construction of aquaculture station in Agadir	Feasibility study	STCOF-ACUALOG	1,2	European Union (EU)	15	Under execution
	Construction & equipment	-	-			

Form the above-described matters, it is considered that INRH will be able to perform various procurement activities required for the Project independently. Since the Project is rather large-scale with project cost of 6 – 7 billion Yen and the INRH and DPM had been working together as executing agency for the past projects, however, it will be the best if both NRH and DPM be as implementing agency.

6.2 Organizational system of implementation

The figure below shows the Project implementation system for each option shown in Table 6-1.

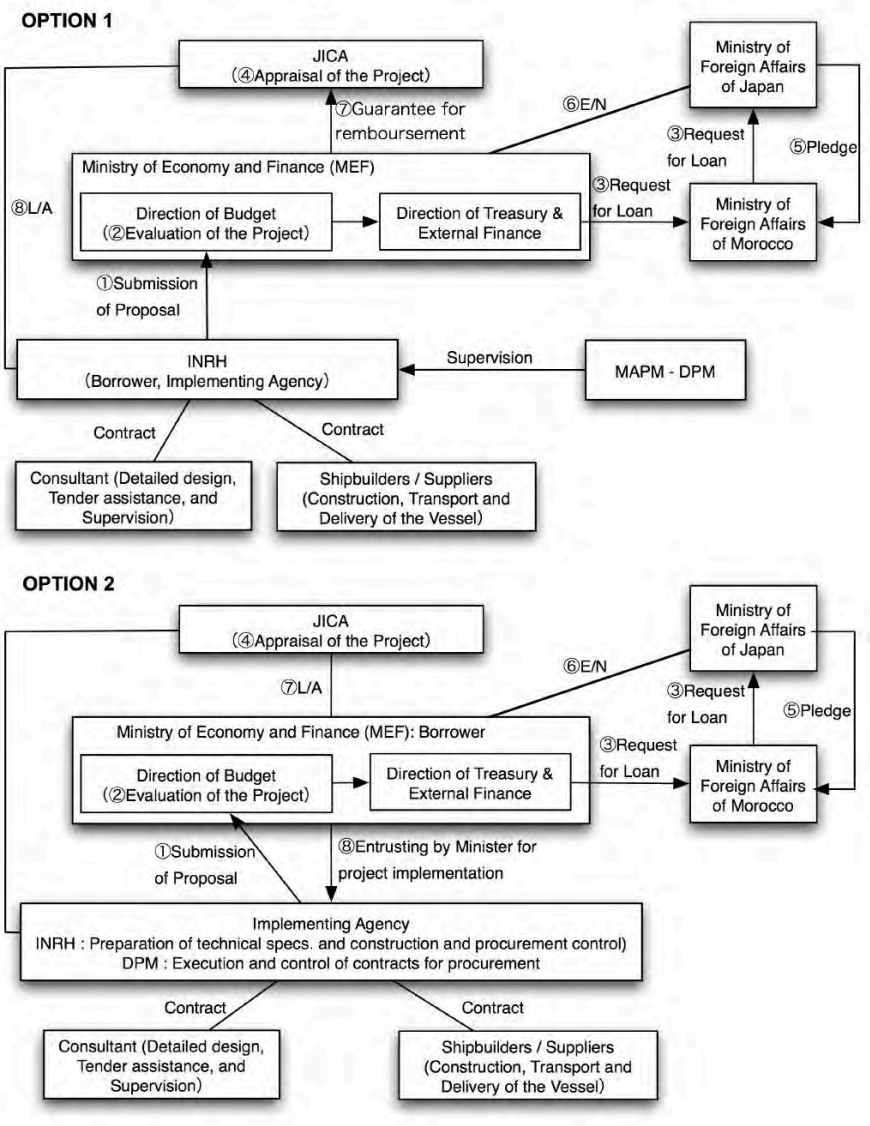
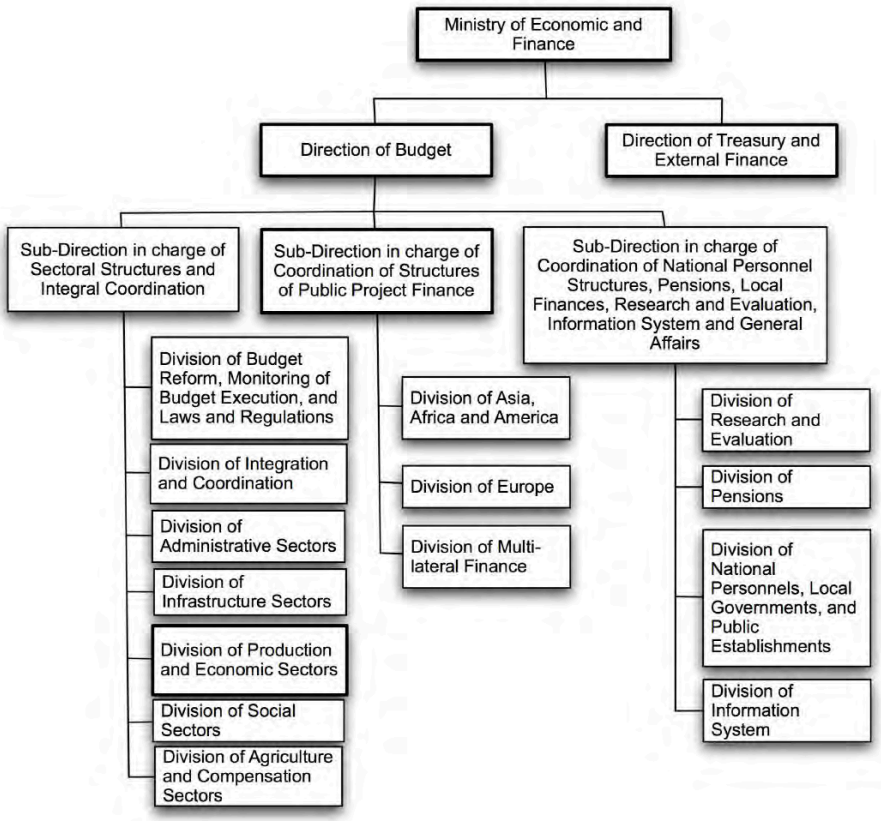


Figure 6-1: Project implementation system

(1) Department of Budget of MEF

For the implementation of the Project, the Department of Budget of MEF will confirm and evaluate the content of the budget application submitted by the executing agency for the Project. If it deems as appropriate project, the formal loan request will be made through the Department of Treasury and External Finance, who will also serve as contact point for loan request, procedures and contracts. On the other hand, examination of the Project prior to the loan request will be done at the Productive Sectors and Economic Division (responsible for projects related to MAPM) within the Sub-Department of Sectoral Structure and Integrated Coordination. The roles and authorities of the entire MEF related to the implementation of the Project will be defined and clarified after the selection of options on project implementaiton system as afore-mentioned.

The organization chart of the Budget Department of MEF is as follows:



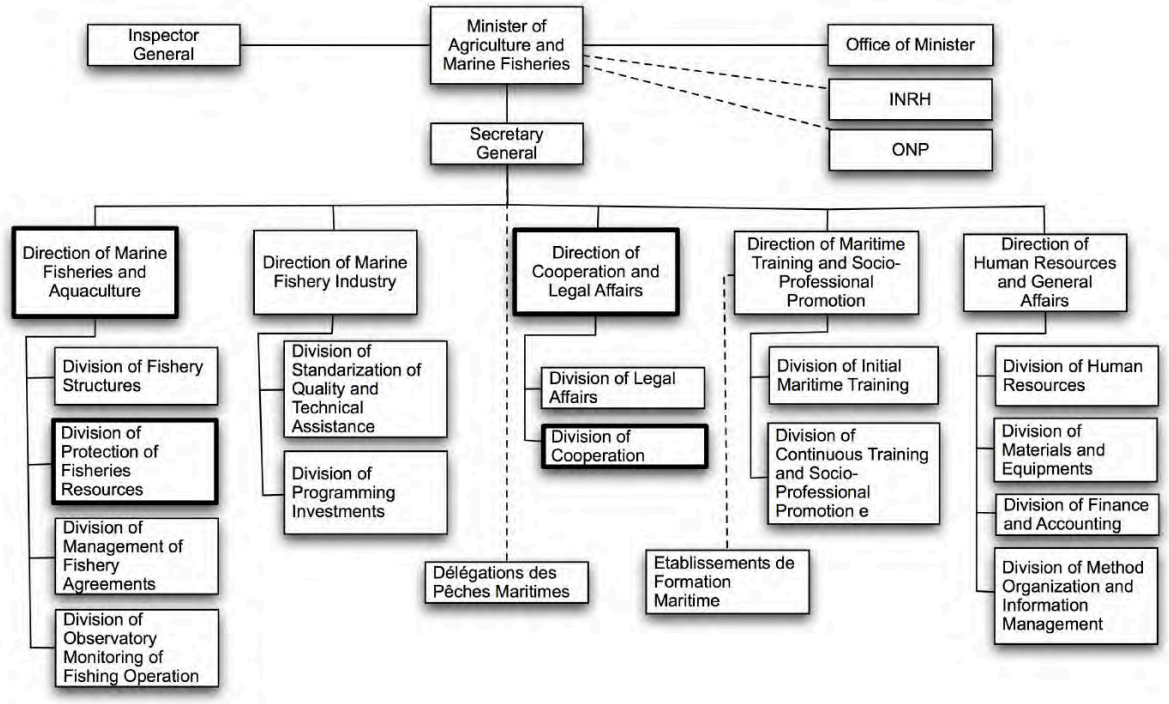
Source : MEF

Figure 6-2: Organization chart of Budget Department of of Ministry of Economy and Finance

(2) DPM of MAPM

1) Organization

The MAPM is composed of the DPM and the Department of Agriculture, and for each Department, a General Secretary is assigned. The executing agency of the Moroccan government for this Project is the DPM, while the valid contact point is he Directorate of Cooperation and Legal Affairs which is responsible for international cooperation matters in fisheries. The following figure shows the organization chart of the DPM.



Source：MAPM

Figure 6-3: Organization chart of DPM

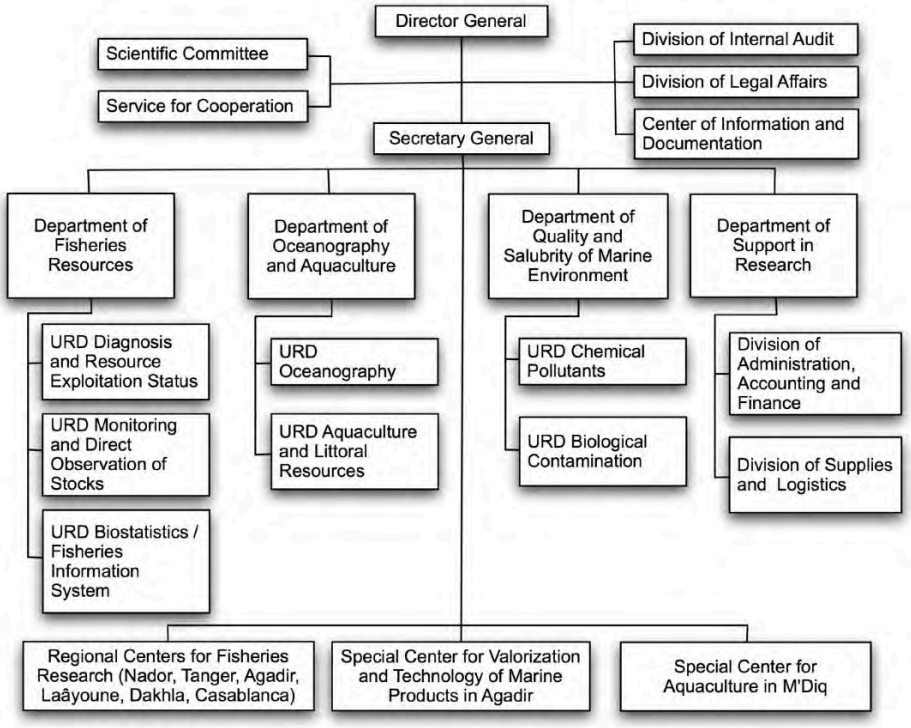
2） Staff Number

The staff number (in 2011) of the Department of Marine Fisheries (DPM) of MAPM has 1,374 people, including executive staff of 475 persons and non-executive ones of 899 people. Total number of staff working in MAPM is 6,270, of which about 22% are occupied by DPM.

(3) INRH

1) Organization

The operating and maintenance agency of the Project will be the National Institute of Fisheries Research (INRH, headquarters: Casablanca). INRH will be responsible for technical operations in the implementation phase of this project and will provide the implementing agency, DPM, with technical support. INRH undertakes all survey and research activities in favor of the five objectives of (a) evaluation and monitoring of fishery resources, (b) monitoring of marine environment, (c) ecosystem survey on marine and coastal water, (d) improvement of fishing techniques and valorization of fishery products, (e) aquaculture research. The organizational chart of INRH is diagrammed in the figure bellow.



Source: INRH

Figure 6-4: Organization chart of INRH

2) Staff number

INRH employs a total of about 400 people comprising of 214 researchers (149 men, 65 women), 46 men of the crew, 90 officers of administration, and 50 other officers. The staff of INRH, as shown in the table below, has increased from about 390 in 2007 to 400 in 2011; and has reached 450 people in 2012, in view of the objectives of "Halieutis Plan ". For implementaition of the Project, approx. 10 staffs of Department of Support in Research of INRH will directly take in charge. As for technical evaluation and management, naval archicture and engineering field will be covered by Supplies and Logistic Division, while scientific equipment related matter will be controlled by the chiefs of relevant departments and chiefs of relevant URDs.

Table 6-3: Increase in INRH staff

	2007	2008	2009	2010	2011
Senior executives (A)	193	197	200	200	215
Supervisory staff (B)	106	110	113	117	113
Enforcement agents (C)	15	19	22	23	23
Total executives / researchers (A+B+C)	314	326	335	340	351
Crew officers (D)	45	42	41	40	46
Temporary job (E)	39	35	14	2	0
Grand total (A+B+C+D+E)	**398**	**403**	**390**	**382**	**397**

Source: INRH

6.3 Financial and Budgetary Situation

(1) DPM

The budget amount of MAPM is of 2,26 millions of Dirhams and that of DPM, that is 20 %. The annual budget of DPM knew a constant increase during the period 2007 to 2012, exceeding the operating budget (excluding staff costs) from 91 to 132 million DH, and the investment budget from 128 to 320 million DH. In particular, the operating budget in 2012 and the investment budget from 2009 have increased significantly. The first results largely from the doubling of the subsidy to the

INRH, but it is not a sudden budgetary increase, because until 2011, the subsidies to INRH have already been subject to a series of rectifications and of adjustments. The latter is explained by the commencement of the granted subsidies to the National Fisheries Office (ONP) and the Development Fund of Marine Fishery created in 2009 (see Table below). Among them, a subsidy has been allocated to INRH for operating expenditures (including personnel costs) of 54 million dirham in 2012 (186% increase compared to 2011), and investment expenditures of 30 million dirham each year.

It should be also noted that in 2012, the Marine Fisheries Chamber was created and composed of public and private representatives in order to promote the dialogue on the actions of fishery resources management, and subsidy to these agencies was newly institutionalized. The subsidy allocated to the investment budget includes also the contribution of the Marine Fisheries Development Fund. This fund is used for different types of fisheries development including support to surveys and researches, and 100% financed by the National Budget. On the other hand, on the revenue related to license fees of national fishing ships and the income received from foreign fishing vessels under fishing rights, at present, 60% is allocated to the INRH and 40% goes to the State Treasury. In addition, the INRH is negotiating with the Ministry of Economy and Finance to be able to use 90% of this income.

Table 6-4: Increase of annual budget of DPM (in DH)

Item	2007	2008	2009	2010	2011	2012
Operating Budget	**91,016,000**	**91,016,000**	**94,016,000**	**96,851,000**	**90,000,000**	**132,371,000**
1) Real Estate	4,434,000	4,225,000	4,525,000	4,315,000	4,754,000	5,204,000
2) Purchase of office supplies	1,620,000	1,810,000	1,810,000	1,650,000	1,650,000	1,767,000
3) Travel and transportation	9,100,000	9,100,000	9,100,000	9,100,000	10,350,000	11,800,000
4) Car park management	2,565,000	2,650,000	2,800,000	2,730,000	2,730,000	2,930,000
5) Taxes and duties / charges	7,831,000	7,831,000	6,331,000	6,311,000	6,391,000	6,460,000
6) Subsidy to INRH	23,350,000	23,350,000	26,350,000	29,185,000	29,185,000	54,185,000
7) Subsidy to DPRH	16,500,000	16,500,000	16,500,000	16,500,000	17,700,000	19,400,000
8) Transfer to training facility	22,920,000	22,120,000	22,120,000	22,120,000	12,420,000	21,800,000
9) Subsidy to CPM	-	-	-	-	-	4,032,000
10) Other operating expenses	2,696,000	3,430,000	4,480,000	4,940,000	4,820,000	4,793,000
Investment budget	**128,058,000**	**128,058,000**	**350,058,000**	**353,058,000**	**330,000,000**	**320,050,000**
1) Sectoral studies	10,454,520	10,815,000	2,199,860	7,586,000	6,580,000	2,300,000
2) Infrastructures	55,963,975	43,864,380	59,322,230	61,870,400	98,622,000	80,475,000
3) Equipment	9,570,505	11,400,860	7,436,730	8,377,000	5,980,000	14,631,000
4) Subsidy	39,000,000	41,400,000	265,040,000	259,200,000	208,300,000	205,850,000
a) DPRH	3,700,000	3,700,000	3,700,000	3,700,000	3,700,000	3,700,000
b) INRH	30,000,000	31,000,000	30,000,000	30,000,000	30,000,000	30,000,000
c) ONP	-	-	100,000,000	100,000,000	100,000,000	100,000,000
d) Marine Fishery Development Fund	-	-	125,840,000	120,000,000	120,000,000	100,000,000
e) Training Institutions	5,300,000	6,700,000	5,500,000	5,500,000	4,600,000	4,600,000
5) Maritime surveillance	0	3,068,000	4,193,000	1,170,000	1,500,000	2,500,000
6) Maritime Rescue	9,020,000	14,000,000	2,133,810	4,420,000	2,160,000	6,570,000
7) Misc.	4,049,000	3,509,760	9,732,370	10,434,600	6,858,000	7,724,000

Source : DPM

(2) National Institute of Fisheries Research (INRH)

Annual budget of the INRH has been doubled from 107 million dirham in 2007 to 221 million DH in 2012, we also assist to a regular mobilization of governmental subsidies so that since 2009; its budget remains stable at 200 million Dirham. As far as the operating expenses are concerned; their resources are stable namely due to the regular allocation of governmental subsidies, and in addition to fishery research taxes. Moreover, since 2011, the Institute perceives the earning related to the services that seem to be increasing as the needs in terms of inspection surveys entrusted by the private sector is increasing. On the other hand, the resources of equipment expenditures are also stable, namely due to An allocation of quota-sharing related to fishing rights and governmental subsidies. From the implementation of Pla, Halieutis in 2009, the amount of these governmental subsidies tend to increase. The annual amount of capital subsidies remained stable in the order of 30 million DH because it is

distributed according to the size of facilities of which INRH disposes (including two existing research vessels); and it is expected that once the next research vessel is acquired and the upgrade of the allocated means, this amount will be increased in view of the Plan Halieuties objectives as it is the case of the operating subsidies. Budget for equipment has also been increasing with the implementation of various projects. Especially in 2010 and 2011, the artificial reefs project (JICA) has increased the budget for equipment compared to the year 2012 (see Table below). The amount of wages and salaries of staff was increased from about 50 million DH in 2007 to some 74 million DH. It is said that there is no problem in terms of increased personnel costs related to recruitment of officers and crew of the new research vessel. It is also said that all members of the crew of the research vessels, whose status was previously contracted personnel, have become regular staff. Their salary system is under review by the government.

Table 6-5: Evolution of the annual budgets of INRH (in DH)

Headings	2007	2008	2009	2010	2011	2012
[REVENUES]						
Operating expenses	**65,092,050**	**87,324,142**	**82,716,360**	**93,913,623**	**91,792,446**	**102,625,327**
1) Available operating funds	-	4,165,820	27,268,360	16,527,971	6,535,691	5,656,104
2) Tax of fisheries research	17,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000
3) Revenues related to chartering	12,000,000	9,000,000	3,000,000	-	4,500,000	-
4) Provision of services	-	-	-	-	10,500,000	12,384,223
5) Subsidy for operation	23,350,000	23,350,000	26,350,000	29,185,000	29,185,000	54,185,000
6) Subsidy for equivalence	-	20,635,000	-	20,513,365	-	15,000,000
7) Additional subsidy	-	-	-	-	25,000,000	-
8) Exceptional subsidy	-	11,873,322	3,000,000	6,000,000	-	-
9) Balance of reimbursement	12,242,050	-	7,800,000	6,187,286	71,755	-
10) Interest on current A/C	500,000	300,000	300,000	500,000	500,000	400,000
11) Research vessel discount	-	-	-	-	500,000	-
12) Credit of payment	-	3,000,000	-	-	-	-
Equipment budget	**42,113,434**	**76,083,469**	**125,403,473**	**167,424,179**	**225,039,700**	**118,434,868**
1) Research vessel discount	1,262,147	-	-	-	-	-
2) Available equipment funds	10,851,288	8,844,710	10,964,656	-	-	2,380,623
3) Subsidy for equipment	30,000,000	30,000,000	30,000,000	30,000,000	30,000,000	30,000,000
4) Balance of reimbursement	-	-	-	-	-	1,190,484
5) Share of EU envelope	-	22,000,000	33,048,000	33,000,000	66,000,000	25,000,000
6) Subsidy for equivalence	-	2,000,000	10,962,968	-	-	-
7) Profit from transfer of vehicles	-	238,759	242,810	-	-	-
8) Discount for unemployment of research vessels	-	-	396,222	502,043	-	-
9) Remainder of the funds allocated by the AECID	-	-	13,788,817	12,157,003	16,438,934	1,000,000
10) Millennium Challenge Account - Morocco	-	-	-	14,265,133	20,081,248	20,676,000
11) Artificial Reefs Project	-	-	-	52,500,000	72,519,518	8,187,761
12) Rehabilitation of the lagoon in Oualidia	-	-	-	5,000,000	10,000,000	-
13) DPM Contribution	-	-	-	-	-	15,000,000
14) Credit of commitment	-	13,000,000	26,000,000	20,000,000	10,000,000	15,000,000
[EXPENSES]						
Operating fees	**65,092,050**	**87,324,142**	**82,716,360**	**93,913,623**	**91,792,446**	**102,625,327**
1) Manpower cost	50,696,135	62,814,125	58,277,108	63,825,000	70,709,004	73,880,000
2) Other operating expenses	11,065,700	17,506,000	20,656,000	26,052,810	14,764,810	20,986,650
- Consumable purchase of materials and supplies	930,000	1,400,000	1,250,000	1,250,000	510,000	1,390,000
- Non-stocked purchase of materials and supplies	1,875,000	1,960,000	2,560,000	2,811,000	2,013,000	2,280,000
- Purchase of work, studies and services	160,000	200,000	700,000	2,500,000	2,500,000	2,000,000
- External expenses	4,540,000	5,520,000	6,380,000	7,960,000	5,650,000	8,470,000
- Other external expenses	2,965,700	3,266,000	4,126,000	4,766,810	3,346,810	5,210,000
- Taxes	525,000	5,110,000	5,610,000	6,725,000	675,000	1,566,650
3) Operating R.A.P	3,320,215	4,004,016	3,783,252	4,035,813	6,318,632	7,758,677

4) Credit of commitment	-	3,000,000	-	-	-	
Expenses for Equipment	**42,113,434**	**76,083,469**	**125,403,473**	**167,424,179**	**225,039,700**	**118,434,868**
1) Credit of report	15,564,225	8,844,710	18,964,656	14,079,316	29,492,176	-
2) Credit of payment	26,549,210	54,238,759	80,438,817	133,344,864	185,547,524	72,739,557
- Fisheries surveys	11,785,190	30,900,000	34,400,000	20,106,000	28,617,616	20,300,000
- Studies, research and testing	4,884,020	5,900,000	6,150,000	64,116,718	94,985,173	17,170,489
- Other capital expenditures	9,880,000	17,438,759	39,888,817	49,122,136	61,944,735	35,269,068
3) Credit of commitment	-	13,000,000	26,000,000	20,000,000	10,000,000	15,000,000
4) Operating R,A,P	-	-	-	-	-	30,695,311
Total	107,205,484	163,407,610	208,119,833	261,337,802	316,832,146	221,060,195

Source: INRH

Among the budgets of equipment expenses above described, the amount of credit that can be used for commissioning and maintenance of the two existing research vessels changes from year to year between 11.8 to 344 millions of DH. Unless a major repair and chartering of fishing vessels (Chartering of the training vessel “Al Hassani” of the ISPM or of those of the private sector at the end of the resources’ surveys), the annual budget of navigation and maintenance amounted to nearly 20 million DH (see table below). Once the new research vessel will be implemented, it will increase the budget for capital expenditures including positions of navigation and maintenance; however this will not be a problem because: 1) expenditures of commissioning can be reduced, given that following the revision of the salary scales of officials, the salaries and allowances of seafarers will be taken on the budget for operating expenses, 2) one of the existing research vessel (R/V. "Charif Al Idrissi") will be taken out of service in 2020, the fiscal burden will be reduced accordingly, and 3) from the implementation of the new research vessel, we anticipate an increase in the amount of subsidies granted by the Government.

As shown in the table above, from the point of view of budgetary resources, there are several sources of budget such as (a) loans of available funds (Fund of Development of the Maritime fishing in particular), (b) revenue from the tax research, (c) revenue from chartering, and (d) revenue from the service. On the other hand, capital expenditures are covered, in addition to government subsidies, by (a) the budgets of various projects, and (b) the share of the EU envelopment (charges relating to access to fishing), other than the subsidy from the MAPM.

Moreover, among the budget items of capital expenditure described above, the amount of credit that can be used for operation and maintenance of two existing research vessels are evolved between 11.8 to 34.4 million dirhams per annum. Unless otherwise the large-scale repair and charter of fishing boats are not made, the annual budget for operation and maintenance generally amounts to 20 million dirhams (see Table below). Moreover, both MEF and DPM have acknowledged the necessity to increase the budget for navigation and maintenance of the Vessel.

Table 6-6: Budget evolution of maintenance and navigation of INRH research vessels (in DH)

Headings	2007	2008	2009	2010	2011	2012
Machine parts purchasing / Fishing gear	1,500,000	12,000,000	13,000,000	4,000,000	4,000,000	2,000,000
Purchase of fuel etc.	2,845,000	3,990,000	4,490,000	5,326,000	7,340,000	6,090,000
Maintenance and Repair	2,300,000	8,500,000	10,100,000	4,000,000	3,000,000	2,000,000
Purchasing of office supplies	430,000	600,000	600,000	450,000	1,150,000	900,000
Postage / Telecommunications fees, customs duties, chartering insurance charges of the vessel	480,190	720,000	1,020,000	1,100,000	7,017,616	2,350,000
Purchase of service provision	4,230,000	5,090,000	5,190,000	5,230,000	6,110,000	6,960,000
Total	11,785,190	30,900,000	34,400,000	20,106,000	28,617,616	20,300,000

Note: For the years 2008 and 2009, the expenses related to maintenance and repairs were predominant, since the equipment and machines of R/V "CAI" were replaced.
For the year 2011, the expenses related to the chartering of fishing vessels (4 million DH) are included.
Source: INRH

Chapter 7 Navigation, Operation and Maintenance System of the Project

7.1 Navigation plan

On the basis of "3.1.5 Survey design", the navigation plan of the new research vessel and existing research vessels is defined as follows.

7.1.1 Prerequisites

(1) The new research vessel

1) Unit working time

Pelagic trawling	: 1 hour / station
Semi-pelagic trawling	: 0.5 hours / station
Bottom trawling (Depth of 0 to 200m)	: 1.5 hours / station (trawling 0.5 hour)
Bottom trawling (Depth of 200 to 800m)	: 2 hours / station (trawling 0.5 hour)
Deep sea trawling (Depth 800 – 1,500m)	: 2.5 hours / station (trawling 0.5 hour)
Benthos sampling / Bottom sediments	: 0.5 hours / station
Multinet towing and sampling	: 0.5 hours / station
CTD Survey / Rossette water sampling	: 0.5 hours / station

2) Navigation speed

Navigation	: 12 knots
Acoustic survey	: 10 knots
Trawling	: Semi-pelagic 5 knots, bottom 4 knots, Deep sea 3knots
Oceanographic survey at fixed points	: Stoppage

3) Survey hours per day : 24 hours

(2) Existing research vessels (R/V "AMA", R/V "CAI" and "AL HASSANI")

1) Unit working time

Pelagic trawling	: 1 hour / station
Bottom trawling (Up to 200m depth)	: 1.5 hours / station
ditto (depth 200 - 800m)	: 2 hours / station
CTD Survey	: 0.5 hours/ station

2) Navigation speed

Navigation	: 10 knots (R/V "AMA") 7 knots (R/V "CAI")
Acoustic survey	: 10 knots (R/V "AMA")
Bottom trawling	: 4 knots
Oceanographic survey at fixed points	: Stoppage

3) Number of survey hours per day : 15 hours/ day

(3) Number of navigation and port-call days

		New Vessel (Spring & Autumn) and "AMA" (Spring)	"AMA" and "AL HASSANI" (Autumn)
Navigation	Agadir～Saidia	2.5 days	2.5 days
	Safi～Agadir～Safi	1 day	1 day
	Boudjor～Laayoune～Boudjor	0.7 day	–
	Laagouira～Agadir	3 days	3 days
	Total	7.2 days	6.5 days
Port-call	Nador	1 day	–
	Tanger	1 day	2 days
	Agadir	4 days	8 days
	Laayoune	2 days	–

	Dakhla	2 days	1 day
	Total	10 days	11 days

7.1.2 Navigation plan

Referring to the above prerequisites on the one hand and the survey design shown in Chapter 4 on the other hand, the navigation plan on the new research vessel and existing research vessels is designed as follows:

(1) New research vessel

1) Autumn campaign (Ecosystem survey + Pelagic survey)

Survey Item		Duration of survey (hours)				
		Atl. South (Cap Blanc～Cap Boujdor)	Atl. Centre (Cap Boujdor～Cap Cantin)	Atl. North (Cap Cantin～Cap Spartel)	Méd (Cap Spartel～Saida)	Total
Demersal trawl	0-200m	40	26	15	8	89
	200-800m	16	19	20	14	69
	800-1,500m	24	28	21	6	79
CTD / rosette		50	50	41	37	178
Bongo / multinet		33	43	25	35	135
Sediment (benne/carottier)		16	21	13	18	68
Pelagic trawl		80	80	50	35	245
Semi-pelagic trawl		6	6	3	2	18
Multi-bean scan (sea bottom)		10	11	9	3	32
Acoustic survey distance (mile)		209	252	123	69	652
Total		23.3	25.8	13.9	9.5	72.6
						89.7

2) Spring campaign (Ecosystem survey + Demersal surveys)

Survey Item		Duration of survey (hours)				
		Atl. South (Cap Blanc～Cap Boujdor)	Atl. Centre (Cap Boujdor～Cap Cantin)	Atl. North (Cap Cantin～Cap Spartel)	Méd (Cap Spartel～Saida)	Total
Demersal trawl	0-200m	80	53	30	17	179
	200-800m	32	38	40	82	192
	800-1,500m	48	55	43	13	158
CTD / rosette		66	75	48	60	248
Bongo / multinet		33	43	25	35	135
Sediment (benne/carottier)		16	21	13	18	68
Pelagic trawl		13	17	10	14	54
Semi-pelagic trawl		3	4	3	4	14
Multi-bean scan (sea bottom)		19	22	17	5	63
Acoustic survey distance (mile)		128	134	87	77	426
Total		18.2	19.2	13.1	13.5	64.0
						81.1

Given the foregoing, the number of operating days per year by the new vessel is estimated at 171 days (including the number of port-call 20 days). The vessel is also allocated to joint surveys and so assigned to respond to requests from outside agencies.

(2) Existing research vessels (R/V "AMA" and R/V "CAI")

1) R/V "AMA"

i) Monitoring survey of demersal species (Autumn)

a) Depth 0 – 200m

Survey Item		Duration of survey (hours)				
		Atl. South (Cap Blanc～Cap Boujdor)	Atl. Centre (Cap Boujdor～Cap Cantin)	Atl. North (Cap Cantin～Cap Spartel)	Méd (Cap Spartel～Saida)	Total
Demersal trawl	0-200m	180	38	83	45	345
	200-800m	0	0	0	0	0
	800-1,500m	0	0	0	0	0
CTD / rosette		10	4	8	2	24
Bongo / multinet		0	0	0	0	0
Sediment (benne/carottier)		0	0	0	0	0
Pelagic trawl		0	0	0	0	0
Semi-pelagic trawl		0	0	0	0	0
Multi-bean scan (sea bottom)		0	0	0	0	0
Acoustic survey distance (mile)		120	25	55	30	230
Total		20.7	4.4	9.7	5.2	39.9
						57.4

b) Depth 200 – 800m (by chartering “AL HASSANI”)

Survey Item		Duration of survey (hours)				
		Atl. South (Cap Blanc～Cap Boujdor)	Atl. Centre (Cap Boujdor～Cap Cantin)	Atl. North (Cap Cantin～Cap Spartel)	Méd (Cap Spartel～Saida)	Total
Demersal trawl	0-200m	0	0	0	0	0
	200-800m	68	30	100	60	258
	800-1,500m	0	0	0	0	0
CTD / rosette		2	2	5	5	15
Bongo / multinet		0	0	0	0	0
Sediment (benne/carottier)		0	0	0	0	0
Pelagic trawl		0	0	0	0	0
Semi-pelagic trawl		0	0	0	0	0
Multi-bean scan (sea bottom)		0	0	0	0	0
Acoustic survey distance (mile)		34	15	50	30	129
Total		7.0	3.1	10.3	6.3	26.8
						44.3

ii) Pelagic resources’ survey (Spring)

Survey Item		Duration of survey (hours)				
		Atl. South (Cap Blanc～Cap Boujdor)	Atl. Centre (Cap Boujdor～Cap Cantin)	Atl. North (Cap Cantin～Cap Spartel)	Méd (Cap Spartel～Saida)	Total
Demersal trawl	0-200m	0	0	0	0	0
	200-800m	0	0	0	0	0
	800-1,500m	0	0	0	0	0
CTD / rosette		50	50	41	37	178
Bongo / multinet		26	34	20	28	108
Sediment (benne/carottier)		0	0	0	0	0
Pelagic trawl		80	80	50	35	245
Semi-pelagic trawl		0	0	0	0	0
Multi-bean scan (sea bottom)		0	0	0	0	0
Acoustic survey distance (mile)		209	252	123	69	652
Total		23.7	26.2	14.3	9.8	73.9
						91.1

Given the foregoing, the number of operating days per year is estimated at 148 days for R/V "AMA" (including 21 days port-call) and 44 days for the chartered “AL HASSANI” (including 11 days port-call).

2) R/V "CAI"

i) Navigation designed to the inter-calibration with R/V "AMA" (1st year)

Zone	Trawl		Oceanography	Total No. of stations	Movement between stations (hours)	No. of days			
	0-200m	200-800m	CTD			Research	Movement between stations	Navigation	Total
Cap Blanc – Cap Boujdor	180	68	0	248	220	16.5	14.7	4.5	35.7
Cap Boujdor – Sidi Ifni	38	30	0	68	57	4.5	3.8	1.2	9.5
Sidi Ifni – Cap Spartel	83	100	0	183	150	12.2	10.0	3.5	25.7
Cap Spartel – Saidia	45	60	0	105	86	7.0	5.7	2.5	15.3
Total stations	345	258	0	603	513	40.2	34.2	11.7	86.1
								Rest	11.0
								Total	97.1

ii) Navigation designed for the inter-calibration with the new research vessel (2nd year)

Zone	Trawl		Oceanography	Total No. of stations	Navigation survey (hours)	No. of days			
	0-800m	800-1500m	CTD			Research	Movement between stations	Navigation	Total
Cap Blanc – Cap Boujdor	131	0	0	131	124	8.7	8.3	4.5	21.5
Cap Boujdor – Sidi Ifni	155	0	0	155	147	10.3	9.8	1.2	21.3
Sidi Ifni – Cap Spartel	93	0	0	93	88	6.2	5.9	3.5	15.6
Cap Spartel – Saidia	107	0	0	107	102	7.2	6.8	2.5	16.5
Total stations	485	0	0	485	462	32.4	30.8	11.7	74.9
								Rest	11.0
								Total	85.9

Given the foregoing, the number of days at sea per year for R/V "CAI" is estimated at 97 days for the first year (including the number of stopovers is 11 days) and 86 days (the number of stopovers is 11 days). It is recalled that from the third year, this vessel should be put out of service due to obsolescence.

7.2 Operation and Management Plan

7.2.1 Organizational plan for management

(1) Issues in terms of organization system of operation and maintenance

Operation and maintenance of the research vessels are handled by Supplies and Logistics Division of Department of Support in Research of INRH. While there are no particular issues on the technical plan concerning goods procurement, the port in/out procedures, repairing arrangements, the following issues are to be reported on the maintenance.

i) Expenses related to navigation and maintenance of research vessels, certainly, in the budget, which nevertheless reduces most often at the stage of budget negotiations with the MEF. This sometimes results in a lack of funds for the purchase of spare parts or repair.
ii) The use of income from entrusted surveys or inspections conducted by the INRH is subject to the prior approval of the DPM and the MEF. The formalities require 2 to 3 months. Because of this, the income cannot be assigned immediately to emergency services such as survey equipment repair.
iii) From 2012, all crew members whose status was previously contracted personnel, have become regular staff (Since the salary system for public servants is under review, the vessel crew's salary in 2012 is allocated and disbursed from the navigation cost.), but have a number of officers and crew of age. It is recommended to plan proactively hiring new crew that is conducive to replace without delay the retirements, coaching and trainings that are required.

(2) Organizational improvement plan

In order to better face the challenges described above, the INRH conceives the idea of creating an independent organization ("business unit") relating to the management of navigation and maintenance of its research vessels. INRH currently has technical and administrative departments, but does not have an operating division. The idea is therefore to make of its Supplies and Logistics Division of Department of Support in Research an independent organization known as a "business unit", to allow operations to ensure high navigation and maintenance of all its flotilla research. It is scheduled to complete the juridical arrangements for reorganization within INRH within 6 month commencing from February 2013, and the discussion and coordination with MAPM and MEF including the budgetary arrangement for 2014 in the following 6 months, so as to be approved as formal

organization. For the costs of management and maintenance, the INRH thinks of some form of donations from the fisheries and aquaculture, the opportunity to be borne by universities and research organizations concerned are also under the study. As the new research vessel is in the benefit of the Ministry of Agriculture and Marine Fisheries (MAPM) and aquaculture and fisheries sectors, the INRH plans to develop an organizational system allowing to support and accompany navigation and operation / maintenance of the vessel by the world of fishing and aquaculture including the department and agencies throughout the sector. It is supposed that the operation and maintenance cost of the Vessel would be covered by 4 sources such as i) subsidy from MAPM, ii) donation from the relevant fisheries organization, iii) cost sharing by relevant universities/institutes, and iv) INRH's own income. This business unit will be independent as "Vessel Operation and Fishing Technology Center", taking charge of operation and maintenance of the research vessels and development of fishing technology. In the future, it will be combined as one business unit including the existing Fishery Products Valorization and Technology Special Center in Agadir, Aquaculture Special Center in M'diq, and Aquatic Animal Pathology Laboratory in Tanger.

On the other hand, in the case where the Department of Support in Research would continue to perform the navigation management of research vessels, it would be desirable, at least, that other revenues (contracted studies and inspections) of the INRH be set aside under "Maintenance Fund" within the INRH, so as to enable the Institute to use its own discretion.

7.2.2 Personnel plan

The required number of the crew (officers + non-commissioned officers) for the navigation operations of the new research vessel is of 20 persons, and in addition to this, scientific staff of 15 persons and, if necessary, 5 co-researchers (in case of Plan A only), that is, the maximum number of 35 to 40 (see table below).

Table 7-1: Crew and scientific researchers of new research vessel

Category	Number of memebers	Composition
Officers, noncommissioned officers	9 officers	(Gateway staff) Captain, 2nd captain, 3rd officer, 4th officer, technician/engineer (Machinery staff) chief engineer, 2nd engineer, 3rd engineer, 4th engineer
	11 non-commissioned officers	(Deck staff) Boatswain, 2nd boatswain, Sailors (4) (Machinery staff) Chief oiler, Oiler (Kitchen staff) chief Cook, Cook, waiter
Scientists	15 researchers	Chief Scientist, Responsible of Data analysis (2), Responsible of Biological survey (2), Responsible of Oceanographic survey (2), Responsible of Benthos survey (2), Responsible of Marine mammals and birds survey (2), Responsible of Bottom sediments survey (2), Responsible of acoustic survey (2)
Co-researchers	5 persons	Professor, student of 2nd/3rd cycle (4)

In accordance with the system of maritime registration of Morocco, which has ratified the International Convention on Standards of Training for Seamen Certification and Watch-keeping (STCW), in the case of the new research vessel, it must have officers with the following qualification.

Table 7-2: Officers onboard of new research vessel

Position	Qualification	Required conditions
Captain, Second captain	Holder of Fishing Master or Captain of the 2nd class in the Marine Merchant	Must have patent of fishing master of the fishing vessel with a gross tonnage exceeding 150 tons, and justify at least 24 months of navigation on board of fishing vessels of this type

3rd/4th officer	Holder of Fishing Master or Captain of 2nd class in the Marine Merchant	Must have patent of fishing master of the fishing vessel with a gross tonnage greater than or equal to 150 tons, and justify at least 12 months of navigation on board of fishing vessels.
Chief engineer	Holder of 1st Class Engineer rom Marine Merchant	Qualification of Chief Engineer of the vessel main engine 2,001-4,000 hp
Second chief engineer	Patentee to 2nd class Engineer or 1st class Lieutenant mechanic from the Marine Merchant	Must have patent Chief Engineer of the ship main engine of 1,001 – 2,000 HP and justify at least 24 months of navigation vessels with a capacity greater than or equal to 1,000 hp.
3rd/4th engineer	Licensee of 1st class Lieutenant mechanic from the Marine Merchant	

In case of existing research vessels, the captain, the second captain, the chief engineer, and the second chief engineer of R/V « AMA », as well as the captain, the second captain and the chief engineer of R/V « CAI », that is a total of 7 members, are licensed of 2nd class (Captain or Chief Engineer), and have over 20 years experience onboard the vessel. Among the new research vessel's officers, chief engineer who should be a person who holds the license of 1st class Engineer from the Marine Merchant, has to be newly hired from outside. The entitled person should be selected and hired among graduates of the Higher Institute of Marine Studies (ISEM). For any other position, the Institute can select a qualified person to be assigned among the existing 7 license-holders of 2nd class (Captain or Chief Engineer). It is expected, however, that when the new Vessel is acquired, some existing officers can take their pensions in the age limit.

It is necessary therefore to ensure regular officers respectively, so as to carry any serious impact on existing vessels and navigation to ensure a smooth service of the new vessel. Similarly, to ensure effective crew other than officers, persons holding certain required certificates must be either transferred to existing vessels or be newly hired. Given that 98% of crew of the existing research vessels of the INRH are occupied by graduates from ISPM, it is possible to predict the recruitment of graduates from ISPM. The ISPM annually produces a sufficient number of graduates as shown in the table below, most of which stand as crew of fishing vessels. It seems that there is no problem regarding the recruitment of new members of the crew needed.

Table 7-3: Number of graduates from ISPM

Course / Graduate month/year	Fishery Lieutenant (2 years)	Lieutenant Fishery Mechanic (2 years)	Treatment and Valuation of Fishery Products (2 years)	Fishery Captain (4 years)	Fishery Mechanic Officer (4 years)	Total
June 2010	34	35	19	10	12	110
June 2011	8	16	21	13	19	77
June 2012	30	29	13	15	14	101

NB : fishery Lieutenant, Treatment and valuation of fishery products, Fishery Captain, fishery mechanic officer
Source : ISPM

On the other hand, for the scientific staff, INRH researchers have certainly an experience of participating in survey campaigns conducted by foreign research vessels of Spain or Norway, and seem to have backgrounds knowledge and qualifications sufficient to allow them continue the ecosystem surveys through the new research vessel and its survey equipment being equipped. Before everything, however, it's necessary now to inquire about their experience of use and handling capacities of each materials to be newly installed. When it is the question of trawling at deep levels whose depth reach some 1,500m, the existing research vessels' seafarers do not have experience, it seems necessary to assign and hire an experienced fishery head, as well as training and supervision through technical cooperation in particular.

7.2.3 Maintenance and management plan

To keep the new research vessel in good operating conditions all the time, it is necessary to implement a range of periodic maintenance and repairs as well as daily checking and maintenance.

(1) Periodic repair and maintenance

Part	Content	Frequency
Plating, deck and superstructure	Maintain in good condition and paint	Once a year
Various inputs on decks and shores	Maintain the hatch coaming and closure means and windows etc..	Once a year
Machines' drums	Maintain the hatch coaming and closure means and windows etc..	Once a year
Ventilation (ventilation chimneys, air ducts)	Maintain closure means	Once a year
watertight compartments	Maintain closure means	Once a year
Bulwark	Maintain the the door and articulation of the spillway	Once a year
Drainage (drain pipe, suction pipe and valves)	Maintain in good condition	Once a year
Mooring and docking facilities	Maintain in good condition	Once a year
Steering gear	Maintain in good condition	Once a year
Fire protection facilities	Confirm the control situation and maintain in good condition the fixed fire-extinguishing, removable and portable fire extinguishers, protective clothing and fire.	Once a year
General machinery space	Maintain in good condition the main engine, auxiliary shafts, propeller arms pipes, control devices, electrical appliances and switchboards	Once a year
Main engines, generators	Confirm the anti-vibration rubbers	Once a year
Main engines, auxiliary	Maintain in good condition the machine bolts and chock liners. Adjust the central axis of the crankshaft journal	Once at every 5 years
Electrical installations	Maintain in good condition the insulation resistance of generators, switchboards, electric motors and cables.	Once at every 5 years
Freezing equipment	Maintain in good condition the safety device	Once at every 5 years
Keel, rudder	After dry docking maintain in good condition and paint	Once at every 2.5 years
Intake pipes and drainage water under deck margin, taking water to the sea	After dry docking maintain in good condition	Once at every 2.5 years
Rear ends of the stern tube	After dry docking maintain in good condition and paint	Once at every 2.5 years
Propeller	After dry docking maintain in good condition and paint	Once at every 2.5 years
Deck machinery, fishing gear	Control of hydraulic pumps and hydraulic motors Replacing of anti-corrosion zincs of oil cooler Applying grease to the hydraulic motor Applying grease to safety valves Painting the exposed portions of the equipment Extra grease to gears and rotating thrust Control of wear of the brake linings	Once at every 2 years
Facilities and fishing nets	Transfer or replacement of the main warp Other replacement cables of each winch Replacement of the fishing net	Once a year Once a year Once at every 3 months
Observation and survey	Regular checks and adjustments	Once a year

equipment		
Main engines, generators	Replacing anti-vibration rubbers	Once every ten years (1/10 years)

(2) Daily maintenance and repair

Part	Content	Frequency
Body of the vessel, accommodation	Washing exposed parts, office cleaning, organizing, Washing deck structure	Every day before going back to port
Engines, machines	Cleaning the machinery compartment	Daily
Deck machinery and fishing equipment	Confirm that the noise is normal. Confirm that there are no oil leaks. Confirm that the delivery pressure of each pump is included in the predetermined values.	Daily
	Cleaning filters Rust protection and application of lubricating oil and grease to some action parts Control quantity of lubricating oil and extra	Once a week
Fishing gear and fishing net	Maintenance and cleaning of fishing nets Lubrication of the main warp Lubricating each part of each block and winch	Before all returns to port Before all returns to port 1 time per week

7.3 Cost of operation, management and maintenance

7.3.1 Terms of approximate calculation

It is assumed that the new research vessel is completed and delivered in the year 2018, and its periods of normal use are 25 years. In the event that the existing research vessels, R/V "CAI" would be put into service for two years from 2018 (to be decommissioned in 2020), and R/V "AMA" for 13 years from 2018 (to be decommissioned in 2031), approximate navigation, operation and maintenance cost has been calculated per vessel per year. Basic conditions for calculation are as follows.

i) Salaries and bonuses of crew are based on the values produced by post during the period 2005 - 2011 in order to deduce the numerical values in 2018 (the first hypothetical year of entry into service) that were selected.

Position	Captain / Second Captain	Chief Engineer, Second Chief Engineer	3rd and 4th class Navigation Officers	3rd and 4th class Engineers	Radio Officer	Boatwan	Deck hand	Chief greaser	Chief cook	Others
Annual salary (including bonus)	297,711	168,994	153,196	138,830	159,655	133,800	113,397	118,387	122,904	117,267

ii) Allowances for crew onboard and scientific researchers are calculated on the basis of the criteria of the current state mentioned below.
- Officers, researchers : Daily allowance 200 DH per day (at sea), 80 DH per day (on land, officers only), and 200 DH for food allowance per day (at sea).
- Non-commissioned officers: Daily allowance 150 DH per day (at sea), 70 DH per day (on land), 200 DH for food allowance per day (at sea).

iii) Material costs (fishing gears, spare part of machineries, fitting, etc.) are calculated based on the actual expenses of existing research vessels.

iv) Repair costs (repair costs, inspection fee) are calculated based on the actual expenses of existing research vessels, in proportion to ages and gross tonnages. It is assumed that the periodic inspection of Lloyd's Register will be once every 5 years, and normal inspection each year.

v) Costs for fuel: Consumption of fuel (by engine power) is calculated on the basis of the

survey navigation plan, dividing into the mode of operation: during normal cruise, acoustic survey, trawling and stop (observation at fixed points, mooring at sea and in port). The fuel is a general diesel oil (Diesel 50), which can be purchased without tax in the case of fishery-related vessels, so that current price (excluding tax) is used.

vi) Lubricating oils are approximately calculated dividing into by powers of main engine, generators and machinery and by operational modes, using the current unit price (450 DH/20L).

vii) The calculation of the freshwater is made on the assumption that the freshwater tank of each vessel would be filled up at each stop (unit price: 22.29 DH/m3).

viii) For the new research vessel, mooring expenses were estimated, in the event where an annual contract for use of wharf would be signed with the ANP because it is difficult to ensure a mooring area in fishing port zones. Concerning the existing research vessels, the actual values (average) of these last 7 years were taken into consideration.

ix) The insurance premium fee for the vessel, designed for navigating at international waters, at 25 years depreciation, was estimated at 0.2 % of the remaining value of the vessel at each year (almost equal to that Japanese R/V “Yoko Maru”). In case of the existing research vessels, the actual insurance fee (average of these last 7 years) is applied. However, the insurances covered for the existing research vessels are of type "all risks" covering the expenses for dry-docking, periodic maintenance of machines, and repair and replacement of equipment for survey and navigation. INRH paid once the repair cost and charges, but are refunded by insurance company and are assumed as revenue of the INRH. Therefore, the insurance fee applied for new research vessel is calculated, as same as the case for Japanese R/V "Yoko Maru", assuming that it was an insurance to only cover damage due to accidents at sea (do not cover the costs of periodic repairs, etc.). For reference, the annual insurance fee paid in respect of existing research vessels is set at an amount equivalent to the R/V "AMA" (aged 12 years), for remaining value (49,972,671 DH) x 1.94 %, and R/V "CAI" (aged 26) for remaining value (1,982,995 DH) x 5.87%, plus 7% tax and 200 DH stamp duty, are fairly expensive fee.

x) Postage and telecommunications costs were estimated following that annual Japanese R/V "Wakataka Maru".

7.3.2 Approximate calculation of the cost of navigation and maintenance

(1) The new research vessel

As indicated in the table below, the annual cost of navigation and maintenance of the new research vessel is calculated, as an average of 25 years, about 21.7 million DH/year in case of Plan A (approx. 18.0 million DH for the first year) and 18.3 million DH in case of Plan B (approx. 15.4 million DH for the first year).

Table 7-4: Cost of navigation and maintenance of new research vessel

(in million DH)

Elements	Ventilation	Plan A (In case of 1,100GT)		Plan B (in case of 800G/T)	
		1st year (2020)	25 years annual average	1st year (2020)	25 years annual average
Labor cost	Crew salary	2,967	2,967	2,967	2,967
	Daily allowances and food for crew and researchers	2,642	2,642	2,340	2,340
Material cost	Fishing gear, spare parts of machine, fitting, etc.	300	1,112	300	1,028
Repair cost	Repair cost and inspection fee	881	4,199	641	3,057
Fuel expenses	Fuel oil, lubricating oil, fresh water	9,642	9,679	7,869	7,906
Port charge	Berth fee	201	201	146	146
Insurance	Insurance fee of the vessel	1,080	613	840	477
Misc.		300	300	300	300
Total		18,012	21,713	15,458	18,276

(2) Existing research vessels

As indicated in the table below, the annual cost of navigation and maintenance of the existing research vessels is estimated at 13 to 14 million DH/year for R/V "AMA", and at 10 to 12 million DH/year for R/V “CAI”.

Table 7-5: Cost of navigation and maintenance for existing research vessels

(in millions of MAD)

Elements	Ventilation	R/V AMA (293G/T)		R/V CAI (397G/T)	
		2019	2019 - 2030 annual average	2019	2020
Labor cost	Crew salary	2,100	2,100	2,510	2,510
	Daily allowances and food for crew and researchers	1,316	1,316	1,092	1,023
Material cost	Fishing gear, spareparts of machine, fitting, etc.	1,057	952	778	781
Repair cost	Repair cost and inspection fee	1,927	1,374	2,983	1,572
Fuel expenses	Fuel oil, lubricating oil, fresh water	4,190	4,194	2,831	2,593
Port charge	Berth fee	74	74	147	147
Insurance	Insurance fee of the vessel	1,082	1,082	327	327
Misc.		865	865	923	923
Total		13,693	13,038	11,590	9,877

(Note) Cost of navigation and maintenance for R/V AMA includes the cost of chartered vessel “Al Hassani”.
R/V CAI and R/V AMA will be operated for calibration of accuracy each other.

Given the foregoing, during the first two years after the entry into service of new research vessel (assumed in 2020), it would be necessary to significantly increase the budget for navigation and maintenance (39.0 – 41.6 million DH for first year). It should be noted, however, after the out of service of R/V "CAI" in 2020, this cost would be approximately from 31.2 to 34.7 million DH in annual average.

The details of cost of navigation and maintenance are shown in Annex 6-3.

7.3.3 Possibility of integrating expenditures of navigation and maintenance in the budget

Given the fact that the "Plan Halieutis" mainly emphasizes the importance of education and research in the field of fishery resources, it is said that there is a high possibility of acquiring a budget to cover the cost of navigation and maintenance. In this regard, the annual budget of the INRH has increased from 25 million DH during the period from 2011 to 2012 and it is expected that this trend may continue from now on.

Morocco has been emphasizing the development of science and technology aiming to increase the GDP share from 0.2% to 2% so as to be a Science & Techno state like Switzerland. Thus, a very high priority given to activities of survey and research can provide a relative advantage in terms of budget discussion with other sectors. Consequently, with respect to expenses related to navigation, it seems that there are no budget problems to finance an increase in labor costs due to the recruitment of crew for the new research vessel and navigation expenses including fuel costs (cf, section 6.3)

However, for maintenance expenses, the leaders of each division verify the status of each equipment, the frequency of use and the need for maintenance and repair, in order to calculate an estimated cost and ask for necessary budget. However, the requested budget is not fully approved but reduced at the MEF. This results in a lack of funds for maintenance costs in actual operation of equipment. In this case, the priority of maintenance and repair is decided by the importance of the equipment. At present, priority is given to the acoustic survey equipment than oceanographic survey equipment.

In addition, any use of the income earned directly by the INRH through contracted surveys in

particular, should be subject to the final approval needed, and after approval, under the control of the MEF. Before final approval, It is held a series of deliberations of a high-level commission called CNRT (comprising of Ministry of Agriculture and Marine Fisheries, Ministry of Public Works, Ministry of Scientific Research, ONP, Chambers of Marine Fisheries, etc.). Because these approaches normally take 2 or 3 months, it is impossible to meet the needs of emergency repairs.

To solve this situation, it would be desirable to newly allocate within the INRH " Maintenance Funds", whose feasibility should be under review at any case.

7.4 Technical Assistance (T/A)

Technical Assistance (T / A) accompanying the present project funded by the ODA Loan in yen will cover the vessel handling, handling equipment, and technology transfer related to the maintenance of the body of the vessel and its facilities, taking into account study activities carried out in the current navigation research.

After studying and reviewing the domains and durations of the Technical Assistance desired by INRH, it was decided not to integrate the study of resources' management for the moment, as well as the analysis and assessment of ecosystems in the Technical Assistance, because these elements are to be planned based on the results of the technical cooperation project in progress.

Here is the basic plan of this Technical Assistance, accompanied with a logical frame matrix of the Project (PDM) and a mobilization plan.

i) Objectives of the Technical Assistance: Capacity Development in terms of commissioning and maintenance of the new research vessel

ii) Areas of expertise (Technical Assistance should include sending several short-term experts to Morocco):

a) Commissioning and maintenance of the research vessel
b) Fishing and navigation techniques (semi pelagic trawling and bottom trawling in particular)
c) Machines' techniques (main and auxiliary engines, freezing equipment etc.)
d) Survey techniques and through the scientific equipment (and mainly SediGraph : Sedimentometer with X-rays, FlowCam : device for image analysis and quantification of phytoplanktons)
e) Survey techniques through the acoustic equipment (and especially scientific sonar, multi-beam echo sounder, ADCP)
f) Sending short-term experts in other fields, including mapping fishing areas

iii) Period: Three years from 2017 to 2020 (including one year of the construction phase and two years of the operational phase)

iv) Results:

a) The organizational system of management of the new fisheries research vessel.
b) The capacity to commission the new fisheries research vessel will be improved.
c) The capacity to implement the survey equipment will be improved.

(1) Regarding the period of implementation of the Technical Assistance

The Technical Assistance will be launched at the vessel's construction stage. The objective is to analyze the lists of equipment etc.., that the shipyard and each manufacturer will present to the owner (INRH) during and after construction, in order to develop the checklist of stocks of INRH and its staff. This will allow having an appropriate organizational system to realize the adequate operations f management immediately after commissioning the projected research vessel, so as to make possible the implementation of baseline activities with confidence.

The 3 year-implementation period of the Technical Assistance requested from INRH seems

sensible. However, depending on the results of the technical cooperation project in progress, it will be necessary to consider the opportunity of integrating the activities of fisheries management as well as the analysis and evaluation of ecosystem in this Technical Assistance, in this case, it seems necessary to provide a period of execution of nearly 5 years.

(2) Regarding the mobilization plan of experts

The mobilization plan of short-term Japanese experts needed for Technical Support is as follows:

a) Commissioning and maintenance of the research vessel

The addition of ecosystem survey features to the projected research vessel will have the effect of complicating its commissioning plan, in comparison with those vessels actually owned by INRH. The objective, then, will be enabling the INRH staff and researchers to jointly develop an effective and economic commissioning of vessels, and expand the production capacity of this plan even after the completion of project

In addition, as the number of survey equipment significantly increases, the inventory control of equipment and spare parts etc., Establishing ways of placing orders as well as maintenance of equipment are becoming increasingly important. So as to perform these management tasks systematically, all the efforts will be made to develop a list of supplies in terms of equipment, materials and maintenance manual, in order to implement the preventive maintenance policy (PMP), for ensuring the research navigation without any constraint.

b) Fishing and navigation techniques

Semi-pelagic trawling targeting small pelagic is a fishing method to catch fish school moving in the sea, by adjusting the depth of trawl net. The wind powers (including wind's direction) and surface current (direction and speed of the current) which affect the movement of the vessel, as well as the currents (direction and speed) that have influence fishing gears and fish schools, are considered among the external elements affecting the performance of the semi pelagic trawling. This implies the ability to analyze the information from these external factors in an instance, and judge the actions to be taken against these influences. In addition, it is required to determine the direction and speed of the vessel that are desired to assess the direction and distance of moving fish shoals during the necessary time between detection of shoals and catching through spinning net, so that the opening of the trawling net reaches in time at the shoals arrival time. Moreover, since the shoals of pelagic fish are used to mount avoidance behavior when approaching fishing gear or other obstructions in the sea, it is also required to have particular adaptability to identify these types of avoidance maneuvers depending on the species and take action against all of them.

In commercial fishing vessels in the fishery advanced countries in particular, the skipper or boat master (captain) alone is responsible for a series of gateway works such as detection of fish shoals, collection and analysis of information on external factors, determining points and routes spinning, determining the depth of fishing gear and the vessel's handling. The gateway works' system at the projected vessel which is a fishery research vessel is obviously different of those commercial fishing ships, but the necessary tasks and fishing techniques are not less identical.

Therefore, the officers who will be responsible for navigation and fishing at the gateway of project fishery research vessel must master handling all the equipment (up to higher levels of sophistication, for example, can skillfully use setting handles of all equipment by intuition without having to see them), and must continue to develop the capacity of processing and analysis of information obtained by means of the equipment to the point of being able to fish of all pelagic species. It is intended to perform a special navigation training (about 10 days) as a basis to strengthen this capacity at the costs Technical Assistance.

The sensors designed for supervising the behaviors of fishing gear that are to be installed in semi pelagic trawling engines, are certainly designed and constructed to withstand the hydraulic pressure for underwater use, improper handling will easily penetrate the water through openings. The fact that disassembly operations / reassembly of these sensors will be mainly carried out by the deck crew, it is important to make it clear enough to take the necessary precautions. On the other hand, the

maintenance of these sensors being made by scientists, it is necessary to better understand and implement maintenance procedures such as cleaning the exterior by fresh water when changing batteries, application of greases, replacement of O-rings, internal cleaning with alcohol.

c) Machines' techniques (main and auxiliary engines, freezing equipment etc.)

The training will involve the handling and maintenance of equipment in the machinery space, with particular emphasis on the following matters, which are not yet well established in Morocco.

i) Review of present status of machinery operation and maintenance system and recommendation on improvement (both on board and on land).
ii) Preparation of a practical manual for machinery operation and maintenance (one which describes clearly the demarcation of roles by each crew on board, basic procedures for operation and inspection, trouble-shooting, etc.)
iii) Technical guidance necessary for establishment of the preventive maintenance policy (PMP) in the field of machinery.

d) Survey techniques through scientific equipment

Technology transfer will cover scientific research equipment that are not on board of the existing research vessels, for effective use methods and those of maintenance, with particular emphasis on 'Sedigraph" and "FlowCam" which the INRH researchers do not have experiences.

e) Survey techniques through acoustic equipment

It will be proceeded to the transfer of technology until it reaches the level necessary for collecting and processing of survey data to the practical level, through the effective implementation of acoustic survey equipment. In particular, the technical guidance will be provided with the following equipment.

i) Scientific echo-sounder : Data collection and processing using 4 frequencies (18/38/120/200kHz) will be conducted in the new research vessel, while the exiting R/V. "AMA" using 2 frequencies (38/120kHz).
ii) Scientific sonar : It will be able to provide technical guidance by Japanese experts in case of the FURUNO FSV-30R, but it might be difficult in case of the SIMRAD ME70.
iii) Multi-beam echo sounder : Technical guidance will be provided on collection and processing of sea bottom information. Sea bottom mapping will be guided by the GIS expert indicated in item f).
iv) ADCP : The fact that in the sampling by semi pelagic trawl of small pelagic stocks, the currents of the semi-pelagic zone (direction and speed of the current) that affect the fish shoals and fishing gear are observed by means of ADCP, it is important to place an organization system allowing the sharing of information between the scientific staff and the watch officers of fishing navigation, as well as the common use between them in terms of handling etc.

f) GIS mapping and other fields

Based on various data collected by the new research vessel (sea bottom structure, biological oceanography, physical oceanography, and marine environment), The guidance on GIS mapping technology will be provided. Moreover, in If a technology transfer will be required in fields other than the mapping fishing areas; it would be through the sending of short-term experts.

(3) Project Design Matrix (PDM)

The Project Design Matrix related to the developing capacities of operation and maintenance of the fisheries research vessel (provisional name) is as shown in Annex 7.

Chapter 8 Effects of the Project

8.1 Development of survey data and expected effects

It is assumed that the data obtained through stock assessment survey and ecosystem survey will be used for the following purposes:

(1) Scientific support for development of fishery resources management plan (Partnership and collaboration with the Ministry of Agriculture and Marine Fisheries)

Until now, the INRH presented each survey report and stock assessment reports by species to the DPM, and based on these reports, the DPM develops and decides the resources management plan. Since both DPM and INRH plan for increasing the number of species targeted for stock assessment and management in conformity with the "Plan Halieutis", it seems that target species and areas of quota introduction increase in accordance with improvement in terms of types, nature and survey data accuracy. This will be certainly reflected by the development of survey data. (cf. table below)

Table 8-1 : Volume ratio of each target species for sustainable management

Target species for quotas (project)	Average amount of catches over the past 5 years (2006 to 2010) (t / year)	Percentage in relation to the total amount	
Octopus	45,154	4,4%	96,7%
Squid	21,611	2,1%	
Small pelagics	835,496	82,2%	
Hake	5,410	0,5%	
Lobster shrimp	9,807	1,0%	
Coastal species	58,216	5,7%	
Tuna, swordfish, small tuna species	8,009	0,8%	
Total quantity	1,016,759	100%	

(2) Conservation of marine environments and biodiversity (Joint research with universities and the Ministry of Environment)

There are 8 Moroccan universities having the Faculty of Science and Technology, doing research in the field of marine environment and/or oceanography. INRH develops and maintains a variety of partnerships and collaborations with many of these universities by sending lecturers in particular.

- Univ. Abdelmalek Essaâdi - Tangier
- Univ. Ibn Tofail - Kenitra
- Univ. Mohammed V Agdal - Rabat
- Univ. Hassan II - Mohammedia
- Univ. Hassan II Ain Chock - Casablanca
- Univ. Chouaib Eddoukali - El Jadida
- Univ. Cadi Ayad - Marrakech
- Univ. Ibn Zohr - Agadir

It has been confirmed that there is a particular need for joint research in the field of marine environment and oceanography by teachers and students from those universities, for periodic survey navigations conducted by the INRH through the new research vessel. Following needs for onboard to the vessel exist.

- Mediterranean : Univ. Abdelmarek Essaâdi / Univ. Ibn Tofail – Kenitra
- North Atlantic : Univ. Mohammed V Agadal - Rabat / Univ. Hassan II - Mohammedia
- Central Atlantic : Univ. Hassan II Ain Chock - Casablanca / Univ. Chouaib Eddoukali – El Jadida

- South Atlantic : Univ. Ibn Zohr – Agadir / Univ. Cadi Ayad - Marrakech

Participation of university researchers in survey campaigns of INRH will increase drastically the effect opportunities for joint research with universities, and provide a wider range of survey results. In addition, on the side of universities, it is hoped that this will result in improvement in the research willingness of students of 3rd cycle, educational level, and the increase of young researchers.

(3) Information to fishers / aquaculture farmers

In Morocco, the different organizations related to the fishery are systemized in advance, forming at each port the associations of ship owners by artisanal, coastal, and offshore, whose representatives compose the members of Chamber of Marine Fisheries installed in each of 4 coastal areas of the country. These Chambers serve as coordinators of opinions between the government and the fishers about the actions of resources management deployed by DPM, to allow considering the opinions from the fishers' side in these actions. Information and data needed and requested by the fishers to INRH are as follows:

- Topographic map of the seabed
- Maps of fisheries (including distribution maps of Royal Shrimp, Lobster, Squid, Cuttlefish)
- Biological data (information to manage independently as biological rest)
- Information on improved equipment (eg, the method to reduce damage to the seabed by fishing trap)

It seems that almost all information and data, except those related to the improved fishing gear, may be collected through the commissioning of the research vessel. The sharing of this information would allow, as it seems, the fishermen to save time and expenses to search for fisheries and also to fish taking into account the sustainable use of resources.

8.2 Operating and effect indicators

The operation of research vessel is influenced by natural condition such as weather and wave, and it may sometimes happen that parts of operation have to be stopped due to the occurrence of troubles of engine and/or survey equipment. Taking into account that the existing research vessels have been performed about 85% of the survey plan, the operating indicators for the new research vessel are set forth to cover approx. 85% of the survey and navigation plan (See the table below).

(1) Operating indicators

Indicators			Current situation (existing vessels only)	Plan (2 years after the entry into service of new vessel)
i) Number of survey navigation days per year			Existing vessels (2 units): almost 300 days / year	New Vessel: 145 days / year Existing vessels: 126 days (AMA), 37 days (AL HASSANI), 63 - 73 days (CAI)
ii) Expansion of areas and depths of survey			Pelagics : area up to 500 m isobath Demersal : area up to 800 m isobath	Pelagic zone up to 1 000m isobath Demersal: Zone 1 up to 500m isobath (Plan A), area up to the 200m isobath 1 (Plan B)
iii) Diversification of survey elements	Pelagic resources	Acoustic survey	2 frequencies (38/120 kHz) x 10,000 miles / year	New Vessel: 4 frequencies (18/38/120/200 kHz) x 9,000 miles/ year Existing vessels: 2 frequencies (38/120 kHz) x 8,500 miles / year
		Fish shoal structure survey	Infeasible	Three-dimensional image data on multifrequency screen
		Chalutage semi-pélagique	150 à 200 times/year	New vessel : 300 times/year Existing vessels: 200 times/year
	Demersal resources	Bottom trawling	500 to 600 times/year	New vessel : 260 times/year Existing vessels : 300 times/year
		Deep sea	Infeasible	New vessel : 80 times/year

		trawling		
	Physical oceanography	CTD	About 250 times / year (water temperature / salinity / nuEIRRnt)	New Vessel: 1,000 times / year Existing vessels: 450 times / year
		Direction and speed of the current	Infeasible	Data of ADCP: up to 400 m depth Data of L-ADCP: 400 – 1,500 m depth
		Sea bottom topography	Infeasible	Points of bottom and deep trawling: 80 points
		Sandy marine sediments	Infeasible	230 times / year
	Biological oceanography	Plankton / fish eggs / fry and fingerlings	Performed irregularly (single layer)	450 times / year (multi-layer)
		Benthos	Infeasible	230 times / year
iv) Joint studies with universities (in case of Plan A only)			Number of scholars onboard: none	Number of university students onboard: 32 persons (4 pers. / Area zones 4 x 2 times / year)
v) Survey campaigns to foreign countries			None	To be performed as required.

(2) Effect indicators

Indicators		Current situation (existing vessels only)	Plan (5 to 10 years after entry into service for the new vessel)
Increased species sustainably managed	Target species for quotas	Octopus, small pelagic (South Atlantic zone only)	Octopus, squid, small pelagic fish (all areas, by species), hake, lobster, shrimp
	Development of models for stock assessment and evaluation of target species	[Global Analytical Model] 2 species (mackerel, whiting) [LCA Model] 6 families (pilchard, anchovy, mackerel, sardine, sea bream, prawn) [Global Model] 7 families (pilchard, hake black axillary seabream, prawn, octopus, squid, cuttlefish)	[Global Analytical Model] more than 12 families, 14 species (pilchard, anchovy, mackerel, whiting, hake, whiting, hake, red mullet 2 species, 2 species of saber damsel, common pandora, besgue, sea bream) [Enhanced Production Model] more than 5 families, 7 species (prawn, prawn, octopus, 3 species of squid, cuttlefish) [Global Model] more than 11 families (mackerel, sardines, croakers, Dentex tumifrons, bream, bugs, black bream, conger eels, scorpion fish, rays, sharks)
Preservation of the marine environment and biodiversity	Joint researches with universities	None	There will be at least four common research reports compiled annually for marine environments.
Information to fishermen / aquaculturists	Topographic maps of the seabed	Underwater relief maps of the Mediterranean coast (2002)	Topographic maps of the seabed up to 1 500m depth (scale: 1/150 000)
	Fisheries maps	Atlantic coast (1983 - 1991) Mediterranean facade (2002)	Atlantic coast (1983 - 1991) Mediterranean facade (2002)
	Maps of marine environments	None	Distribution maps for water temperature / salinity / chlorophyll etc.

8.3 Economic Benefits

8.3.1 Concept of benefits

So that fishery resources in the EEZ area of Morocco can be managed and exploited in a sustainable and appropriate way, it is essential to improve elements, quality and quantity of existing survey data. However, existing research vessels, whose survey scope and functions are limited, should be put out of service for R/V "CAI" in 2020, and the R/V "AMA" in 2030, because of obsolescence. Morocco has seen a great change in the volume of catches, despite the efforts to collect and analyze data to manage resources so far undertaken by the two vessels. If a new research vessel is acquired to be able to collect and analyze more comprehensive survey data, variable factors related to fisheries resources (meteorology, marine environment, biological characteristics and stocks of each species, fishing activities, etc.) could better understand including their causal relationships, and ensure the

evaluation and management of resources to highest precision. This would allow fishermen to practice fishing activities in a more efficient way, so that it can be expected as a reduction in variations of capture volume (i.e., stabilization of catches). On the other hand, if a new research vessel was not procured, with the conditions that the existing two research vessels and equipment would become too old to use, it is anticipated that both quantity and quality of survey data would decline and the continuous and appropriate resource management would not be done even for species which are currently under resource evaluation and management. Therefore, the economic benefits from the implementation of new research vessel are assumed as indicated in the table below.

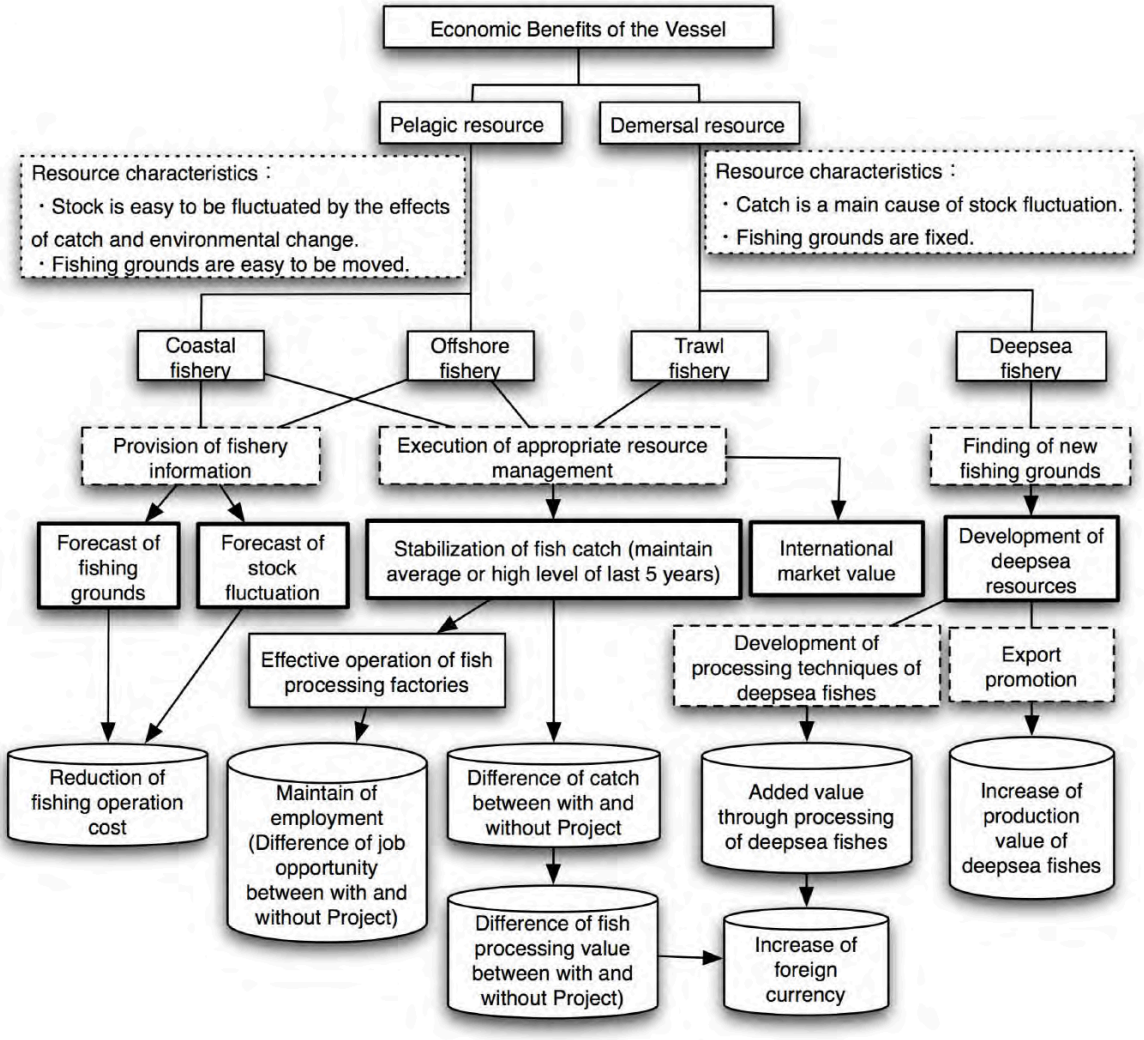


Figure 8-1: Economic benefits through the operation of the research vessel

The following table synthesizes the expected economic benefits

Table 8-2: Expected economic benefits

Benefits	Concept for benefits
i) Stabilization of catches' volume (thanks to the achievement of evaluation of resources management based on the ecosystem approach, the current fisheries and aquaculture resources would be put into operation in a sustainable manner, so that the catches	・ Pelagic fish: R/V "AMA" can be put into service until 2030, if the Project is not implemented, the volume of catches would decline gradually during 5 years after 2031 (It would drop to a low volume changes in recent 5 years, the price of fish would have gone up on the other hand)
	・ Demersal fish, crustaceans, cephalopods: R/V "CAI" could be put into service until 2020, if the Project is not implemented, the volume of catches would decline gradually during 5 years after 2021 (after retirement of CAI) (It will drop to a low level of volume changes in recent

volume would be stabilized.	5 years, the price of fish would have gone up on the other hand).
	・ Effects of improving the accuracy of the survey: If the Project would be implemented, the catch of pelagic and demersal fish will stabilize at least in the same level as the average of the last 5 years, for five years after 2025 (the fifth year following the entry into service of new research vessel) (it would drop to a high level of volumes in recent years, the price of fish would be low on the other hand
ii) Development of fisheries resources in deep sea (The survey on deep sea fisheries resources (depth of 800 to 1,500m) would be conducted, so as to allow the development of un-exploited resources).	・ The catch of royal shrimp (*Plesiopenaeus edwardsianus*) and black hairtail (*Aphanopus carbo*) would increase. (Current depth : 800 – 1,200m -> Future : 800-1,500m).
	・ Processing technologies for unexploited fish (*Alepocephalus bairdii, Alepocephalus rostratus Deania calcea*, current stock estimated by the Survey Team: 26,843 tons) would be developed in order to create value (through technological development carried out at the Specialized Technology Centre for Valorisation of Fishery Products – Agadir of INRH).
iii) Planned operation of processing plants (Stabilization of catch volumes would allow the stable provision of raw materials for transformation and would hope for extending the industrial activities of seafood processing).	・ With the stabilization of the catch, processing plants will be able to procure raw materials in a stable manner, making it possible to use the more planned operations. In case the project is not implemented, with a downward fluctuation of catches, the amount of raw materials processed and the amount of production process (the value added) appear to reduce Likewise
	・ In case the project is not implemented, the decrease in processing volume will prevent maintaining the employment of existing workshops
iv)Improving the predictability of fisheries and stock changes (Information on fishery and marine environments are shared by fishery associations, so as to improve the catch efficiency.	・ The opportunity to learn about the precise positions of fishing which change each year will save the travel time to fishing and operating expenses, while maintaining the current level of catches. Regarding the demersal fisheries which remain constant despite fluctuations in stocks, earnings will not be taken into account.
v) Improvement of the international market value Being able to prevail in the whole world that it is the seafood caught under appropriate management of resources would cause an increase in the market value (obtaining the certification by ecological labels is to be encouraged).	(This is a secondary benefit from resource management, so that quantification is difficult.)

8.3.2 Basis and calculation results

Among the benefits described above, i) through iv) are quantifiable and the results of each calculation are shown in the following. Since the life period of the research vessel is generally assumed 25 – 30 years, it is considered that the benefits from the Project would continue for about 25 years, total of 30 years would be appropriate for economic analysis, by adding about 5 years of project implementation period.

(1) Stabilization of catches volume

Catches in Morocco has trended upward during past 30 years, but remains stagnant since 2001. By species, sardines which occupies nearly 70% of the total, after recording 760 thousand tons in 2001, octopus, after a record 100 thousand tonnes, stagnating at 20 to 60 thousand tons, shrimp level of 8 to 10 thousands, hake constitutes a main demersal species after capture 12 thousands in 2003, stagnating at a few thousand tonnes compared to sea-bream, croaker, sole, etc. Thus, the production of many important species, after catch peaked during the period 2000 to 2003, has stagnated at a certain level.

While it is difficult to estimate the future trend solely by existing catch data, given the situation of catch variation, it is assumed that the capture model (level and trend) during last 5 years (2006 -2010) represents the current state and capture it would take in the future. In other words, it is assumed that

the future catches vary within the capture model of last 5 years, depending on availability (collection and analysis) of data for resource management.

i) In case without the Project:

Pelagics : The current level of the average catch would be maintained until 2030 when R/V "AMA" will be put into service. From 2031 when the vessel will be out of service, if the assessment and management of resources would not be made appropriate, the catch would drop gradually due to overfishing in particular, to reach in 2035 the lowest level of the past 5 years.

Demersal (including cephalopods, crustaceans): The current level of average catch would be maintained until 2020 when the R/V "CAI" will be put into service. From 2021 when the vessel will be out of service for the same reason as described above, the catch would drop gradually, reaching in 2025 the lowest level of the past 5 years.

ii) In case with the Project:

During 5 years after the new research vessel gets into service (expected 2020), a sufficient quantity of ecosystem, survey data would be accumulated, so as to enable realizing an overall assessment of resources. From 2025, the results will be taken into account in the management of fisheries resources, which will maintain the state of stocks of key species in satisfactory conditions. Thus, it is anticipated that the catch will stabilize at a level equal to or higher than the average of the past 5 years.

Scenario 1: Increase in catch volume (scenario taking into account small pelagic quota in 2012)

While the small pelagic quota in 2012 (Stock C only) totaled 1 million ton, domestic production of small pelagics is around 0.8 million ton, which suggests that there is still the possibility of increasing the volume of catch. In this perspective, it is assumed that the catch would be expected to increase to the highest level of the past 5 years.

Scenario 2: Maintain the current catch volume (scenario based on the "Plan Halieutis")

The "Plan Halieutis" expects to maintain that status by the catch of marine fishery, and cover the needs of seafood for 2020 by increasing aquaculture production. In this perspective, it is assumed that the average catch made these last 5 years would be maintained permanently.

Scenario 3: Maintaining catches only for demersal fish (scenario taking into account the unforeseeable changes the natural environment)

At the mentioned Scenario 2, the stocks of demersal fish are affected more significantly by external factors such as climate change and changes in marine environments. For example, the stock of Pacific Pilchard was stable at a high level from 14 to 19 million tonnes during the period from 1981 to 1988, but decreased significantly from 1989 to go down to 0.88 million tonnes in 1994. And what is worse, the stock began to go down in 2000, and stagnated from 2002 to 2007 around 100 thousand. Therefore, it is the capture which is a main factor of fluctuations in stocks, profits from the "stabilization of catches," will be taken into account only for demersal (including cephalopods and crustaceans) on which appropriate management of fishing allows a sustainable exploitation.

On the other hand, given the correlation between the price of the main species (sardine, octopus) and production (supply volumes) we can see that production tends to be roughly inversely proportional to the unit prices of fish (see figure below). This leads to the hypothesis that in the case of catch by species, this would fall to the highest level for the past five years, the unit prices of fish become the lowest, and if not, they become highest.

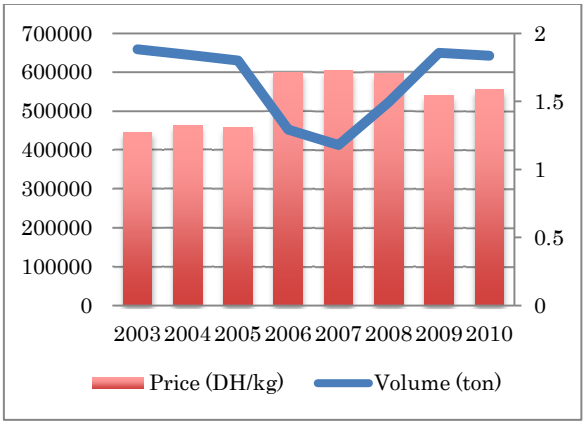


Figure 8-2: Production and unit price of sardine

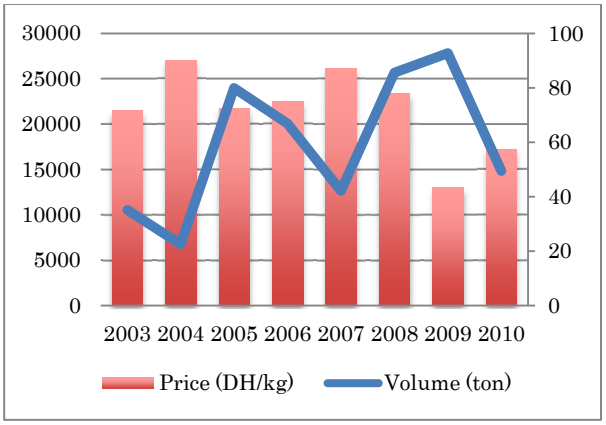


Figure 8-3: Production and unit price of octopus

The table below shows the volume of catches by species in last 5 years, and the price of fish (average, maximum, minimum) used in the calculation of benefits.

Table 8-3: Basic data used in calculation of benefits from stabilization of catches volume

Category	Fish	Species	Fish Production (ton)			Unit Price (DH/kg)		
			Average	Max.	Min.	Average	Max.	Min.
Coastal Fishery	Pelagics	Sardine	536,115	649,930	412,567	1.66	1.73	1.55
		Maquereau	63,244	85,780	40,726	1.50	1.63	1.34
		Anchois	18,665	30,220	9,794	6.10	6.44	5.49
		Chinchard	24,634	31,282	19,715	4.69	5.38	3.63
		Thonides	6,021	8,886	349	28.64	37.19	21.87
		Autres	23,089	57,329	9,835	5.25	5.98	3.58
	Demersal	Loup	132	181	75	63.48	71.35	48.77
		Dorade	1,264	1,433	1,045	32.70	40.89	25.36
		Grondin	2,444	3,254	1,333	9.06	10.73	7.75
		Merlu	4,042	4,970	3,228	26.87	31.39	22.56
		Ombrine	2,822	3,599	1,817	22.03	24.26	19.67
		Pageot	2,298	5,067	510	41.65	66.90	14.60
		Sole	3,531	4,107	3,223	28.35	30.41	27.20
		Autres	62,361	67,631	55,228	11.89	13.51	10.46
Offshore fishery	Demersal	Poulpe	20,207	27,813	12,639	68.09	86.95	43.22
		Calmar	2,083	3,900	480	66.68	97.92	47.18
		Seiche	13,935	19,089	10,910	33.69	44.00	21.43
		Poisson blanc	21,952	25,668	17,528	11.65	13.20	8.00
		Crevettes	4,468	5,763	3,657	125.80	141.91	108.43
	Pelagics		56,633	99,939	31,834	1.49	1.88	1.26
Total			869,942	1,135,841	636,493			

Source : DPM

(Note) Minimum catch of demersal fishes was recorded in 2007, with particular emphasis on Pageot and Calamar having a largest drop. This is because of low rate of trawl operation caused by the longer octopus closing season (7 months) in 2007 comparing with other years.

The table below shows the results of calculation, considering the difference of production value (catch volume x unit price) per species per year as benefit, with and without the Project. For details, refer to Annex 8-1.

Table 8-4: Benefits expected from stabilization of catch (in thousand DH)

	Year	2021	2023	2025	2027	2029	2031	2033	2035
Scenario 1	Pelagic	0	0	66,848	200,545	334,241	436,204	640,129	844,055
	Demersal	103,858	311,575	477,263	393,204	309,146	309,146	309,146	309,146
	Total	103,858	311,575	544,111	593,749	643,387	745,350	949,275	1,153,201
Scenario 2	Pelagic	0	0	0	0	0	109,963	305,888	509,292
	Demersal	103,858	311,575	519,292	519,292	519,292	519,292	519,292	519,292
	Total	103,858	311,575	519,292	519,292	519,292	621,054	810,529	1,029,105
Scenario 3	Pelagics	0	0	0	0	0	0	0	0
	Demersal	103,858	311,575	519,292	519,292	519,292	519,292	519,292	519,292
	Total	103,858	311,575	519,292	519,292	519,292	519,292	519,292	519,292

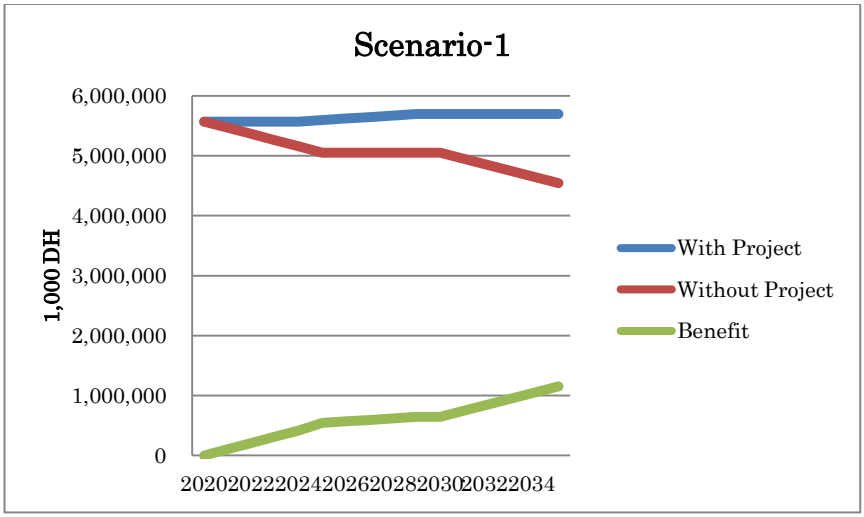


Figure 8-4: Comparison of fisheries production in value (scenario 1)

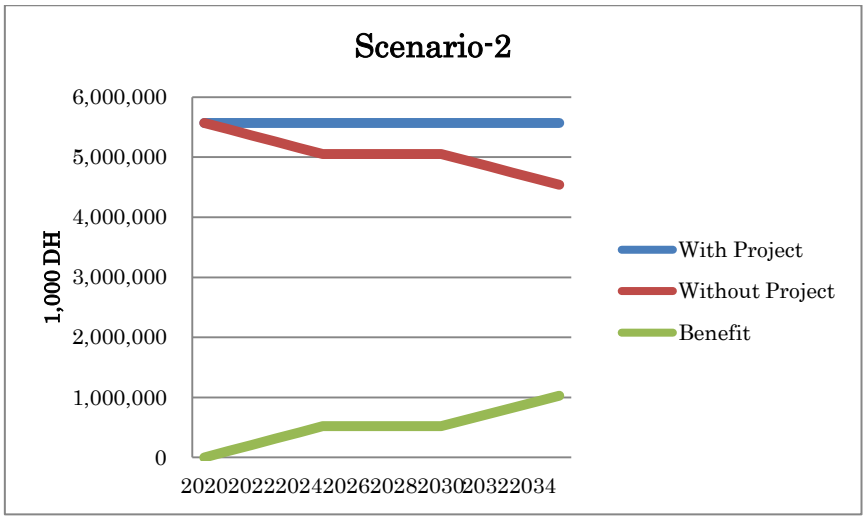


Figure 8-5: Comparison of fisheries production in value (scenario 2)

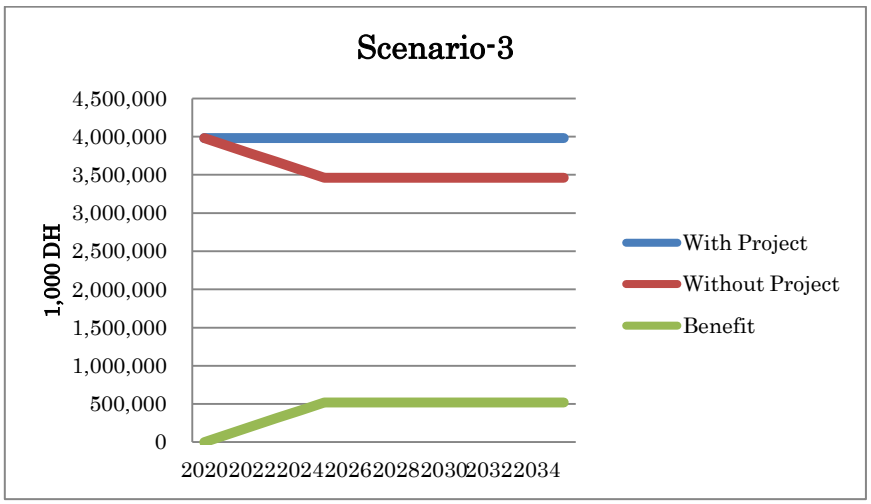


Figure 8-6: Comparison of fisheries production in value (scenario 3)

In the case of Plan A, in addition to the stabilization of catch in Moroccan water as described above, data and information necessary for fisheries resources management and marine environmental conservation in the neighboring countries included in the Canary Current Large Marine Ecosystem (CCLME) (Senegal and Mauritania in particular) would be also collected.

(2) Exploitation of fisheries resources in deep sea

Regarding fisheries resources in deep sea in Morocco, Spanish R/V "VISCONDI OF EZA" had conducted the survey during the period of 2004 to 2006 in the depth of 500 to 2,000m. Results show the existence of some commercially important species and of potential stock to process into seafood products in the future. However, this survey did not estimate the biomass, so that the stocks based on scientific approach remain unknown. Although it is not a scientifically proven method, it is considered estimated amount of biomass can be obtained simply by multiplying catch data per unit area and surface area by depth (see table below).

Table 8-5: Estimated biomass of deepsea fishery resources

Category	Species	Catching volumes per unit (kg/km2)			Estimated biomass (ton)		
		500～800m	800～1200m	1200～1500m	500～800m	800～1200m	1200～1500m
Commercially important species	Royal shrimp	5.9	21.0	10.3	41	179	71
	black scabbard	-	160	108	0	1,362	747
Harvestable species for transformation	*Alepocephalus bairdii*	-	301	1,445	0	2,562	9,992
	Alepocephalus rostratus	-	124	316	0	1,055	2,185
	Squale savate	170	1,180	147	1,175	10,042	1,017

Note: Surface area by depth: 6,914km^2 (500 - 800m), 8,510km^2 (800 - 1,200m), 6,915km^2 (1,200 - 1,500m)
At the depth of 1,500 - 2,000m, the distribution of *Alepocephalus bairdii* was only identified among these 5 species.

i) In case without the Project:

The depth which the existing research vessels can survey is up to 1,000m in case of R/V "CAI" and up to 800m in case of R/V "AMA". Beyond this depth, it is impossible to survey so that the data necessary for resource management cannot be collected. On the other hand, the commercial bottom trawlers practiced deepsea trawl up to the depth of 1,200m at present, and it is likely to exceed the threshold of sustainability in this pace. Therefore, without the Project, existing resources up to 800m depth would be exploitable at an adequate level, but those beyond this depth would not be developed (or exhausted or remained unexploited).

ii) In case with the Project:

The new research vessel allows to do bottom trawl survey up to depth of 1,500m and the environmental and oceanographic survey. Because most useful resources mentioned above are distributed to the seabed up to 1,500m, the status of these resources would be identified so as to set up appropriate biologically allowable catch level. Thus, these unused resources would be effectively utilized. It is assumed that Therefore, the activities of operation and implementation would cover 50% (assumed as the level of sustainable catch) of existing biomass at the depth of 800 to 1,500m in case of Plan A and at the depth of 800 - 1,200m in case of Plan B. In case of deepsea shrimp, it is considered an exploitable quantity would be the amount deducted the average volume of catches (76.5 tons) of the last 5 years.

As for the price of fish, the average price for royal shrimp (96.47 DH/kg) during last 5 years is used, while the average price of black hairtail uses that of silver hairtail since there is no catch data of black hairtail. With regard to exploitable 3 species for which there is no price criteria, the average price of sardines (1.52 DH/kg) will be taken into account. Moreover, it is conceivable that the effects described above occur five years after the entry into service of new research vessel (from 2025), and develop during the following 5 years. For royal shrimp which the exploitation is underway, however, the maximum effects would occur immediately 5 years after entry into service.

The table below shows the results of calculation of differences in production value (catch volume x unit price) per species per year, considered as benefits, with the Project and without the Project. For details, refer to Annex 8-1. Moreover, as stated above, the profit resulting from the "development of fishery resources in deep waters" will not be counted as income in the economic analysis because existing stocks were not estimated in a method scientifically validated.

Table 8-6: Benefits from exploitation of deep sea fishery resources

(1) Plan A

Year		2025	2026	2027	2028	After 2029
Production increase (ton)	Royal shrimp	68.9	68.9	68.9	68.9	68.9
	Black hairtail	755.5	830.2	904.8	979.5	1,054.2
	Alepocephalus bairdii	1,255.4	2,510.7	3,766.1	5,021.5	6,276.8
	Alepocephalus rostratus	324.0	648.1	972.1	1,296.2	1,620.2
	Squale savate	1,105.8	2,211.7	3,317.5	4,423.3	5,529.2
	Total	3,509.6	6,269.5	9,029.4	11,789.4	14,549.3
Benefit (1,000DH)	Royal shrimp	6,577	6,577	6,577	6,577	6,577
	Black scabbard	4,064	4,466	4,868	5,270	5,672
	Alepocephalus bairdii	1,908	3,816	5,725	7,633	9,541
	Alepocephalus rostratus	493	985	1,478	1,970	2,463
	Squale savate	1,681	3,362	5,043	6,723	8,404
	Total	14,723	19,206	23,689	28,173	32,656

(2) Plan B

Year		2025	2026	2027	2028	After 2029
Production increase (ton)	Royal shrimp	33.3	33.3	33.3	33.3	33.3
	Black hairtail	136.2	272.3	408.5	544.6	680.8
	Alepocephalus bairdii	256.2	512.3	768.5	1,024.6	1,280.8
	Alepocephalus rostratus	105.5	211.0	316.6	422.1	527.6
	Squale savate	1,004.2	2,008.4	3,012.5	4,016.7	5,020.9
	Total	1,535.3	3,037.3	4,539.3	6,041.3	7,543.3
Benefit (1 000DH)	Royal shrimp	3,177	3,177	3,177	3,177	3,177
	Black hairtail	733	1,465	2,198	2,930	3,663
	Alepocephalus bairdii	389	779	1,168	1,557	1,947
	Alepocephalus rostratus	160	321	481	642	802
	Squale savate	1,526	3,053	4,579	6,105	7,632
	Total	5,985	8,794	11,603	14,411	17,220

(3) Planned operation of processing plants

Stabilization of catches makes it possible to expect a stable supply of raw materials for processing plants and an improvement in the added value. The average volume and the average value of landings, as well as exports for the past 5 years are as shown in the table below. We will consider as the amount of added value, the difference between the value of exports and the amount of landings of small pelagic fish (sardines, mackerel, anchovies), cephalopods, crustaceans and molluscs, which are the main species in Morocco.

Table 8-7: Added value of the main export species (average of last 5 years)

Species		Average production of the last 5 years (2006 to 2010)		Export average over the last 5 years (2006 to 2010)			Added value (export value - value of production) (1,000DH)	% of exports
		Volume (t)	Value (1,000DH)	Products	Volume (t)	Value (1,000DH)		
Pelagics	Sardine	592,748	962,547	canned / processed	124,478	2,970,736	2,008,189	21%
	Mackerel	63,244	93 202	Canned	11,446	428,309	335 107	18%
	Anchovy	18,665	114,161	Processed	19,065	997,914	883,753	81%
Demersal	Cephalopod molluscs	68,601	2,957,105	Fresh / frozen	24,520	3,505,187	548,081	30%
	Crustaceans	9,812	766,119	Fresh / frozen	12,690	1,135,377	369,258	129%

Source : DPM

If we suppose that on the difference of catching volumes between the execution case and non-execution of the Project, a certain quantity will be exported with an added value, the benefit resulting from the improvement of the added value can be obtained by the following formula for each of the 3 scenarios indicated in "(1) stabilization of catches".

(The difference between the volumes of catches of each year in case of execution and non execution of the Project) x (average processing rate during the last 5 years)/(the average volume of landings during the last 5 years) x (the amount of the added value).

The benefit calculated on the basis of the views described above is as shown in the table below. For more details, see Appendix 8-1. However, this benefit, which is an indirect benefit provided by the stabilization of catches will not be counted as income in the economic analysis.

Table 8-8: Benefit from improved value added (in thousand DH)

	Year	2021	2023	2025	2027	2029	2031	2033	2035
Scenario 1	Pelagics	0	0	44,188	326,483	544,138	633,840	813,243	992,647
	Demersal	13,720	53,768	106,426	145,578	159,512	166,479	166,479	166,479
	Total	13,720	53,768	150,613	472,061	703,650	800,319	979,722	1,159,126
Scenario 2	Pelagics	0	0	0	0	0	89,702	269,105	448,509
	Demersal	13,720	41,159	68,598	68,598	68,598	68,598	68,598	68,598
	Total	13,720	41,159	68,598	68,598	68,598	158,300	337,703	517,107
Scenario 3	Pelagics	0	0	0	0	0	0	0	0
	Demersal	13,720	41,159	68,598	68,598	68,598	68,598	68,598	68,598
	Total	13,720	41,159	68,598	68,598	68,598	68,598	68,598	68,598

(2) Improving the predictability of fishing grounds and stock changes

Small pelagic fisheries vary with changing marine environments, such as water temperature, ocean currents and upwelling. The new research vessel will study and analyze the various factors of the marine environment, so that the positions of fisheries of each year may be known more precisely. Given that the benefiting group oft his advantage is essentially constituted of small coastal purse seiners, it is hoped that appropriate dissemination of information on fisheries allow anglers to save operating costs (including fuel costs required to moving to fishing ground).

As a result of the interviews to owners of purse seiners (El Jadida and Agadir), fishers strongly desire to obtain the information on fishing grounds. Although the fishing vessels would be able to go directly to fishing grounds and reduce the time for searching fish schools, with provision of such information, it is anticipated that fishers would continue to catch fish as much as possible, without changing the regular fishing pattern (departure in the evening and coming back to ports in early morning, 10 – 12 hours/day), considering the fishers mind. The price of fish for processing does not largely fluctuate even if the supply volume increases, although there are some difference by sizes and qualities (0.8 – 2.5 DH/kg). If all fishing vessels could catch a lot of fish, the price of fish for consumers would decline (1 – 20 DH/kg with average of 10 DH/kg). Furthermore, the fishing operation without setting up of the limit of total volume of catch (quota) might cause the deterioration of fisheries resources. It is necessary to control the volume of catch (production) by fishers themselves depending on demand for fish in each region, even if the information on fishing grounds is provided. If the marketing aspect is not considered based on demand for fish for consumers as well as the scale of fish processing capacities in each region, the sales income would not increase although the volume of catch increases and the operating cost reduces. In this point of view, it is necessary to examine the aspects of market, resources and organizations to save the operating cost with the provision of fishing information.

Based on the results of interview at Agadir and provided that the fishing vessels go back to the port when the catch reaches to a certain volume, the saving cost for operation of purse seiners was tried to quantified as follows:

Present:
- Fuel consumption per coastal purse seiner (engine 400 HP):
  400 l/day (40 l/hr. x 10 hrs./day) x 6.65 DH/l = 2,660 DH/day
- Catch volume and sales amount per the above purse seiner:
  Large catch (sell to processing factories):
    5 – 15 tons/day x 2 DH/kg = 10,000 – 20,000 DH/day (Average 15,000 DH/day)
  Small catch (sell to fish markets):
    0.3 – 0.5 ton/day x 10 DH/kg = 3,000 – 5,000 DH/day (Average 4,000 DH/day)
- Proportion of fishing vessels with large catch: 30% (20 vessels out of 70 vessels)
- Average catch per vessel: 10 tons/day x 30% + 0.4 ton/day x 70% = 3.28 tons/vessel/day
- Average sales amount:
  (10 tons/day x 30% x 2 DH/kg) +(0.4 ton/day x 70% x 10 DH/kg) = 8,800 DH/vessel/day

Benefit calculation:

1. In case of small distribution of pelagic fish in the zone where coastal fishing vessels can be operated: Assumed that fishing vessels (50 units) whose catch are small do not go fishing → The operating cost of 70% of fishing vessels (50 units) will be saved, and the remaining 30% of vessels (20 units) will be able to increase the efficiency for searching fishing grounds (assumed that fuel cost be able to reduce to 50%).
   Benefit: 50 vessels (70 vessels x 70%) x 2,660 DH/day = 133,000 DH/day
   20 vessels (70 vessels x 30%) x (2,660 DH/day x 50%) = 66,500 DH/day
   Total 199,500 DH/day

2. In case of large distribution of pelagic fish in the zone where coastal fishing vessels can be operated: The fishing vessels whose catch is small (50 units) will also increase catch as same as fishing vessels with large catch (20 units). → All vessels will be able to save the operating cost with the increase of efficiency for searching fishing grounds (assumed that fuel cost be able to reduce to 50%).
   Benefit: 70 vessels x (2,660 DH/day x 50%) = 93,100 DH/day
   In addition, sales income of fishing vessels (50 units) whose the volume of catch is small, will increase (Assumed that catch will be sold to processing factories having a large demand, it is expected to gain the additional sales income of 417,000 DH/day (50 vessels x ((15,000 DH/day – 4,000 DH/day) – 2,660 DH/day)).

The above calculation is made based on the limited information, so hat it is not possible to account as a benefit in the EIRR calculation. It would be possible to make more accurate benefit calculation if more socio-economic data is collected and accumulated by INRH from now on.

8.4 Economic analysis

An approximate calculation of EIRR is made on the basis of estimated benefits above and costs (cost of project, cost of navigation and maintenance) calculated in Chapter 5, as shown in the table below. In all scenarios and plans (assuming implementation of the project "general untied") the EIRR exceeds 20% (for details, see Annex 8-2). As a result of EIRR calculation for both cases of STEP and general unties projects, the EIRR value was slightly higher in case of STEP.

Table 8-9: Calculation of EIRR

	Scenario 1		Scenario 2		Scenario 3	
	Plan A	Plan B	Plan A	Plan B	Plan A	Plan B
STEP	27.7%	30.0%	26.4%	28.7%	25.0%	27.5%
General Untied	26.4%	28.5%	25.2%	27.3%	23.8%	26.0%

On the other hand, in the operational phase of the new research vessel, we can consider various options such as rising cost of management and maintenance mainly due to the rising price of fuel, and

/ or reduction of income fish production due to a failure of resource management of research (falling prices resulting from overfishing, diminution of stocks etc.). As a consequence, the sensitivity analysis is done in three cases described below.

i) Cases of increase in the cost of management and maintenance

Annual expenditure on purchase of fuel and lubricating oils required for new research vessel are 10.1 million DH in case of Plan A, and 8.4 million in the case of Plan B, and occupy about 45% of the total cost of management and maintenance. The current price of fuel being 6,65 DH/l (Tax excluded), the experience shows that an increase of 15 to 20 % is very likely. Here, to leave a sufficient margin, we retain the respective assumptions of increases of 100% (13.30 DH / l). In this case, the total cost of operation and maintenance increase of 22.5%.

ii) Cases of decreasing profits

As shown in the composition of benefits (Annex 8-1), one of the benefits resulting from the "stabilization of catches," approximately 70% of demersal fish concern octopus and shrimp, and small pelagic species represent approximately 60% of pelagic fish. These species are also those sustainably managed with the introduction of quotas is programmed by DPM 2020. Therefore, we assume that benefits are obtained only by octopus, squid / cuttlefish, shrimps and small pelagics.

iii) The case of simultaneous occurrence of these two

The EIRRs estimated on each of the scenarios, plans, and cases described above are as shown in the following table (for details, see Annex 8-3).

Table 8-10: Results of the sensitivity analysis

Case provided	Loan type	Scenario 1		Scenario 2		Scenario 3	
		Plan A	Plan B	Plan A	Plan B	Plan A	Plan B
i) Case of rising fuel prices by 100%	STEP	26.9%	29.2%	25.6%	27.9%	24.1%	26.5%
	Untied	25.7%	27.8%	24.5%	26.6%	22.9%	25.2%
ii) Cases of decreasing benefits (Benefits only from octopus, shrimp and small pelagics)	STEP	21.3%	23.3%	19.5%	21.4%	17.7%	19.8%
	Untied	20.4%	22.2%	18.7%	20.4%	16.9%	18.8%
iii) Case of simultaneous occurrence of these two	STEP	20.5%	22.4%	18.0%	19.9%	16.6%	18.7%
	Untied	19.7%	21.5%	17.2%	19.1%	15.9%	17.9%

Since the fluctuation of the EIRR remains thin despite an increase in fuel prices, we can say that there are no significant influences on the economic viability of the project. On the other hand, the EIRR is relatively more sensitive to profits from the "stabilization of catches," it seems that the economy of the project depends on whether the data collected by the new research vessel can be effectively implemented in inventory management of more species. However, insofar as the judicious management of resources is at least include the octopus, shrimp and small pelagics, even in the event of rising fuel prices, the EIRR exceeds 15% in all scenarios and plans, the Project is economically justified.

8.5 Social Benefits

Social benefits expected by operation of new research vessel include the following 5 effects.

(1) Early detection and reduction of marine pollution

The ocean is absorbing almost one third of emissions of carbon dioxide in the atmosphere and reduce global warming, thus weakening the absorption ability of sea would result in an acceleration of global warming. In this context, under the International Ocean Carbon Coordination Program (IOCCP) created within the Intergovernmental Oceanographic Commission (IOC) of UNESCO, all the world countries are collaborating to monitor the carbon dioxide in the ocean. The new research vessel should

be equipped with facilities for observation of pH and total alkalinity in seawater, so as to participate in the international cooperation.

In addition, the implementation of this vessel would also track the status of marine pollution due to organic compounds (hydrocarbons) and oils, in order to contribute to the early detection and reduction of pollution.

(2) Increasing employment opportunities for researchers

Commissioning of new research vessel would collect data and samples in the most improved, qualitative and quantitative methods. To perform these operations, processing and analysis of these data, it is expected to increase not only the scientists on board, but also the researchers of INRH responsible for analytical work on the ground, it is also conceivable that the joint research with universities and others occur more actively in order to constantly increase employment opportunities for researchers in these organizations.

(3) Development of education of graduate students and Ph.D. in Environmental Oceanography

The new research vessel (Plan A) is able to accommodate, at each navigation, 5 professors or master and PhD students of the universities concerned. That is to say, there will be 40 persons (5 persons x 8 navigations/year) in total along the year that can participate in joint studies. The universities disposing of faculties related to oceanography and marine environment that are 8 in number in the country, are all in a severe environment for research and survey (no research vessel, lack of study materials) and have great difficulty to acquire the data necessary for their research activities, due to budgetary constraints. The possibility of embarking the vessel designed and participate in joint studies would increase the willingness of each university including the motivation of their students. This translates into an increase in the number of students in master's and doctorate and led to the growth and increase in the level of research in this field.

The marine environmental laboratory at the University Hassan II Ain Chock - Casablanca has 20 registered students, approximately one third are in post-graduate students (Masters and PhD). In addition, the Univ. Abdelmarek Essaadi - Tangier, three research teams in oceanography & natural resources (9 pers.), marine environment & natural risks (7 pers.), and environment & earth science (5 pers.) are interested in embarking the project vessel. Given the foregoing, it is estimated that the country currently has nearly 160 professors and post-graduate students in the field of environmental oceanography (20 persons / x 8 university).

(4) Stable supply of fishery products

Per capita fish consumption in Morocco is 10 to 12 kg/year, but greatly affected by the volume of catch of sardines which occupies approximately 70% of the total, because the small pelagic fishing grounds are in the move under the influence of global climate change. If the effective operation of project vessel would predict in advance the changes in ecosystems and put fisheries information available to fishers in a sensible way, so the catch could be maintained at a high level, so as to allow providing the seafood according to national and international demand. Also, the fisheries resources in deep waters, which are untapped resources, would be put into operation in a sustainable manner. In addition, the data required for the development of aquaculture in terms of early-stage life cycle and marine pollution are made available, so as to contribute to the growth of the production volume of aquaculture.

More specifically, as approximately estimated in the above section in the paragraph on the economic benefits, (scenario 1) the catch volume would be maintained at nearly 1,136 thousand tons (artisanal / coastal + offshore) in maximum, to which a quantity of about 15 thousand tons of newly exploited deep sea fishery resources would be added. Which would represent an increase of approximately 228 thousand tons (22.4%) compared to the average catch volume (1,018 thousand tons).

It is expected that as a result of this increase in catch, per capita consumption would be improved from 11 kg/year to 13.5 kg/year, and in parallel, jobs in the processing industry and aquaculture would be increased from 62 thousand people actually to 75 thousand. The fact that the increase of catch volume would improve CPUE of fishing boats and fishers' income level, it is considered that the number of direct jobs of fishery would be maintained at current levels, even if the catch increases.

Furthermore, the quantity of exports of seafood would also increase in proportion to the increase in catch. The amount of exports of fishery products would be increased from approximately 1.1 billion U.S. dollars currently 1.47 billion.

(5) Contribution to regional and sub-regional cooperation

Activities in the fisheries resources survey and ecosystem survey in the north-west of Africa, including Canary Current Large Marine Ecosystem (CCLME), have been so far carried out mainly by "R/V F. Nansen" (Norway / FAO). The Moroccan water has also surveyed by Spanish and Russian research vessels. In this region, joint survey and research system on regional fisheries resource are under organizing within the framework of Eastern Central Atlantic Fisheries Commission (CECAF), so that it is expected that the Vessel would contribute to such regional based research activities. After introduction of the project research vessel (Plan A), Morocco would be able to actively participate in research collaborations with neighboring countries or international organizations. Thus, the Morocco will occupy a leading position not only in the region, but also could play on the international stage, the role of opinion leaders in the field of marine fisheries research.

8.6 Socio-economic Impact

The main seafood of Morocco is consisted of sardines, octopus and shrimps. In case where the Project would not be implemented, as the existing research vessel goes out of service, monitoring studies of resources would be impossible for the demersal from 2021, and for the pelagic as of 2031, so as not to deepen knowledge of levels and evolution of existing stocks. Which would make it impossible to develop all the action of resource management such as introduction of quotas, and would likely result in overfishing, and in the worst case, by the risk of depletion of fishery resources. Therefore, a depletion of one of the three main species above seems to lead to significant socio-economic losses (negative impact) such as loss of income, bankruptcy of fishery products processing plants, and increasing unemployment (see the table below, for more details, see Annex 8-4).

Table 8-11: Socio-economic losses (case where the project is not implemented)

Heading		Sardines	Octopus	Shrimps
Economic losses	Decrease in fishery production	880 million DH / year	1,330 million DH/year	560 million DH/year
	Decrease in export	374 million dollars/year	309 million dollars/year	98 million dollars/year
	Bankruptcy of processing factories	35 establishments	65 establishments	7 establishments
	Increase of abandoned ships	On the coast : 577	Offshore : 260	Offshore: 59
Social losses	Increase of unemployment (Fishermen)	About. 42,000 pers.	About. 6,800 pers.	About. 900 pers.
	Increase of unemployment (transformers)	About. 9,000 pers.	About. 4,800 pers.	About. 500 pers.

NB: The estimation is made by taking into account respectively the averages of the last 5 years for fish production value and foreign exchange earnings of the last 3 years for the size of the fishing fleet, and these 2 years for the number of processing plants and the number of their employees.

Source: Estimate on the basis of DPM statistics.

On the other hand, if the Project is not implemented, it would be necessary to conduct survey navigation using the chartered research vessel from foreign countries. However, it is actually very difficult to charter a certain fishery research vessel throughout the year. Just for an example, based on the past experiences of Fisheries Research Agency (Japan) in chartering the research vessels similar to the Project vessel, the chartering cost (except operation cost) is estimated as shown in the following table.

Table 8-12: Chartering Cost based on Experiences of Fisheries Research Agency (FRA) – Japan

(Unit: Yen)

Purpose	International Tonnage	Period of Chartering	No. of days	Lowest tender price (incl. tax)	Monthly fee per ton	In case of Plan A	In case of Plan B
Charter Vessel for "Biopsy Survey of Glosbe"	874	June 2 - Junly 11, 2012	39	20,364,849	17,924	19,716,013	14,338,919
Charter Vessel for "Acoustic Trawl Survey of Alaska Pollack"	742	June 13 - July 9, 2012	26	18,900,000	29,390	32,329,463	23,512,337
Charter Vessel for "Monitoring Survey of Large Jellyfish"	742	July 14 - August 1, 2012	18	18,500,000	41,554	45,709,793	33,243,486
Charter Vessel for "Distibution Survey (I) of Pacific White-sided Dolphin and Minke Whale in Autumn"	742	October 12 - November 20, 2012	39	19,338,967	20,049	22,053,560	16,038,953
Charter Vessel for "Distibution Survey (II) of Pacific White-sided Dolphin and Minke Whale in Autumn"	1059	October 12 - November 20, 2012	39	21,946,982	15,942	17,535,905	12,753,385
				Average	24,972	27,468,947	19,977,416
				Annual Charter fee		329,627,361	239,728,990
				Charter fee for 30 years		9,888,820,836	7,191,869,699

Source: Tender Information of Fisheries Research Agency of Japan

From the above table, it is estimated to require approx. 330 million Yen / year (approx. 9.89 billion Yen / 30 years) in case of Plan A equivalent, and approx. 240 million Yen / year (approx. 7.19 billion Yen / 30 ears) in case of Plan B equivalent. Comparing with the construction of a new research vessel, the chartering of vessels would cost more 1.83 times for Plan A and 1.57 times for Plan B.

Chapter 9 Points to be considered to carry out the Project

9.1 Envinronmental considerations

The oceans representing more than 70% of the Earth's surface contribute significantly to changes in the global environment, it is essential to prevent marine pollution from the standpoint of protecting the global environment. In order to prevent pollution by commissioning the new research vessel, it is important to install the systems and facilities described below, so that no problem would occur (by ensuring that there are no issues in compliance with international standards of the International Convention for the Prevention of pollution resulted from vessels, the Convention known as MARPOL), as well as respecting the environment of our planet.

(1) Prevention of marine pollution resulting from oil

i) Providing a tank for oil residues (sludge)
ii) Equipping the oil separator (oil / water) at a concentration of oil less than 15 ppm.
iii) The oil must not be filled in a tank located in front of the collision bulkhead (shock Wall).

(2) Prevention of marine pollution resulting from wastewater

i) Equipping a processing unit of the waste water for discharging sewage (excrements, etc).
ii) Providing a tank for storing bilge waters temporarily and keep them relatively clean (domestic wastewater).

(3) Prevention of marine pollution resulting from waste

i) Equipping a waste disposer (garbage disposal) for discharging waste (including food) at a far point of more than 3 nautical miles.

(4) Prevention of air pollution

i) Equipping with a Propeller power saving system (PBCF : Propeller Boss Cap Fins), taking into account the fact that the reduction of fuel consumption is effective in controlling the emission of CO_2.
ii) Equipping devices for freezing and air conditioning systems not using substances that deplete the ozone layer (including Freon).
iii) Equipping the diesel engine that meets the requirements of the second IMO regulations concerning NOx / SOx.
iv) Equipping an appropriate incinerator to prevent the formation and release of dioxin-like substances

9.2 Laws, regulations and procedures relevant to Project implementation

9.2.1 Acquisition of the Vessel’s flag

The Vessel to be constructed under the Project, after its construction in a foreign country’s shipyard, will be navigated herself with a temporary flag of Vessel to Morocco. After completion of customs clearance in Morocco, the INRH who will be the owner of the Vessel will have to acquire the Moroccan flag in good and due form.

9.2.2 Change of the Vessel’s classification

All existing research vessels are classified by Lloyd's Register. If the acquisition of the classification and regulatory inspection for the planned Vessel were carried out on the basis of a classification other than Lloyd (Class NK, for example) in the country of construction, the INRH

should make necessary arrangements for the change of classification after delivery in Morocco.

9.2.3 Codes and regulations as well as applicable inspections

It is necessary to draw up the plan and build the new research vessel in accordance with the classification codes and conventions listed below, and to submit to inspections by the competent authorities.

The new research vessel must be based on the following classification rules and international convention, designed and built, inspected by the relevant authorities.

1) Rules and Regulations of the Classification issued by NK
2) International Convention on Tonnage Measurement of Ships, 1969
3) International Regulation for Preventing Collisions at Sea, 1972 including latest amendments
4) International Convention for the Safety of Life at Sea, 1974 including its Protocol of 1988 and latest amendments
5) International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 and 1997 relating thereto and including latest amendments
6) Protocol of 1988 relating to the International Convention on Load Lines, 1966 as amended in 2003
7) International Telecommunication Convention, 1982 including latest amendments
8) International Convention on the Control of Harmful Anti-Fouling System on Ships, 2001
9) Adoption of the International Code on Intact Stability, 2008 (2008 IS CODE)

In addition, we inquired about the position and the government's policy on the applicability of the "MLC 2006" (international agreement) and "SPS 2008" (international code) described below, which relate to new research vessel, it became clear that they will not apply it.

In relation to the new research vessel, below mentioned "MLC 2006(International Convention)" and "SPS 2008" (International Cord), the results confirmed the position and policies of the Government of Morocco for each, will not apply with respect to any of the ship.

i) MLC 2006：Maritime Labor Convention, 2006 - ILO

Prescribed matters: Sleeping rooms shall be located above the load line.

Ship application: This Convention shall be applied to all vessels except ships of less than 200 gross tonnage not engaged in international voyages (Other than ships engaged in fishing or in similar pursuits)

Moroccan Government's position:

Government of Morocco is considered to have been made the ratification process on September 10, 2012, ratified and approved after about six months. However, in Morocco, because it is positioned in the category of "fishing vessel" fisheries research vessel, even if ratified this Convention, will not apply with respect to the ship. (Confirmation by the Department of Marine Fisheries (DPM) on November 27, 2012)

ii) SPS 2008：Code of Safety for Special Purpose Ships, 2008 - IMO

Prescribed matters: The Vessel should be designed not to damage stability; even any compartment (sub-division) is filled with water.

Ship application: This code is applicable to more than 500 gross tonnage engaged in international voyages special purpose ships, means a mechanically self-propelled ship, with more than 12 special passengers (researchers).

Moroccan Government's position:

Morocco has consented to the application of this code, and indeed applies to all vessels flying the flag of Morocco gross tonnage exceeding 500 tons which practice international navigation and carrying more than 12 members of special staff. However, given that the "fishing boats" are out of scope and the fishery research vessels are categorized into “fishing boats” in Morocco, there will be no need to apply for the Research Vessel (after the check made by the DPM to the Director of the Merchant Navy, on November 27, 2012).

9.2.4 Decree related to public procurement

Generally the procurement must comply with the provisions of the decree governing public procurement, which as a principle of equal treatment of all competitors and protect the interests of the contracting parties in particular. Under this decree, it is decided under the authority of the Prime Minister, the "tied" conditions were admitted in exceptional circumstances, emergency or special circumstances.

Currently, this decree is now under revision. Implementation of “tied” conditions (ie, Special Terms for Economic Partnership called STEP) for the implementation of the Project is subject to the approval of the Prime Minister, and must also meet the following requirements

(1) There are sufficient specific reasons to justify the application of STEP loan (considering the technical point of view, of the acquisition of goods and services exclusively from Japanese suppliers, and taking into account the situation of the appropriate organization to support the development)
(2) It is clear that the proposed project can contribute significantly to the promotion of Japanese-Moroccan relations (which involves consultation between the Foreign Ministries of two countries). It should be noted further that the Japanese side considers the proposed project as a reflection of the excellent relations between Morocco and Japan in terms of fishery cooperation and the Moroccan party, Morocco favors infrastructure development, and consider to use the loan related to Japanese ODA (STEP loan), taking into account the overall circumstances including the European financial crisis.
(3) There is a political commitment (technical examination is carried out by the Ministry of Economy and Finance (MEF), but it is at the political level to take the final decision.

9.2.5 Procedure of tax exemption

The acquisition of a new research vessel may be subject to: (a) customs duties on imports, and (b) value added tax in accordance with the tax legislation in Morocco.

i) Customs duty on imports 2.5% of the vessel price: If the planned Vessel was built in countries or regions that have concluded the Free Trade Agreement (FTA) with Morocco, however, import duty will be exempted. Furthermore, the goods which value is more than 100 million or 200 million DH (amount under being reconfirmed by INRH), will be also exempted from import duty.
ii) 20% Value Added Tax (VAT) of the vessel’s price: In case where the Vessel is intended to navigate in international waters, however, VAT will be exempted. To benefit from these exoneration measures, the owner (INRH, in this case) must gather certificates and other necessary acts (including international certificate concerning the vessel measurement, Certificate of registration and certificates concerning the principal dimensions of the vessel, issued by the Ministry of Equipment and Transport) to complete all the regular formalities.

Chapter 10 Conclusion and Recommendation

10.1 Conclusion

The new fisheries research vessel which will be acquired within the framework of this project (hereinafter referred to as "the Vessel"), will undertake a wider range of activities and research studies based on the ecosystem approach in the Exclusive Economic Zone of Morocco and its connecting zone. The effective operation of the Vessel will collect and analyze more accurate scientific data, which will be fundamental for sustainable development of the fisheries sector of the country. The acquisition of the Vessel is deemed appropriate and viable to the views described below.

(1) Consistency with the National Policy

The objectives of using the Vessel hinge on three main axes: 1) scientific support in the development and implementation of fisheries resource management plans (in partnership with DPM), 2) conservation of marine environments and biodiversity (in partnership with universities concerned and the Ministry of the Environment), and 3) dissemination of scientific information to fishermen / fish farmers (in partnership with fishing associations). These are deemed as essential inputs to achieve "sustainability", one of the pillars of the development strategy included in the long-term development plan “Plan Halieutis” (towards 2020) of MAPM Morocco. As outputs, the effective operation of the Vessel will surely accomplish an increase in "percentage of sustainably managed species (species caught in quota): 5% -> 95%" among the target figures of the "Plan Halieutis." And once an appropriate resource management would maintain a high stock level, the Vessel would be expected to fulfill a role in the primary process of implementing the "Plan Halieutis", also contributing to other targets related to increase "fish production", "exports of the sea", "per capita fish consumption" and "direct employment (related industry and aquaculture)."

Table 10-1 : Contribution of the Project to the implementation of « Plan Halieutis »

	Estimated Targets of « Plan Halieutis »	Expected increase (contribution of the Project)
Percentage of species sustainably managed	5% → 95%	96.7% (100%)
fisheries production	1,035,000 t → 1,660,000 t	228,000 t (36,5%)
Exports of products	1.2 billion dollars → 3.1 billion dollars	0.27 billion dollars (14,2%)
Per capita consumption	11kg/year → 16kg/year	2.5kg/year (50,0%)
direct employment	61,650 psns → 115 000 psns	About. 13,800 psns (25,9%)

Moreover, the Vessel will increase the total number of survey days, including those carried out by existing research vessels, from about 300 days at present to 534 days (except that for R/V. CAI which is scheduled to be retired in 2020), of which 342 days (171 days x 2 teams day / night shifts) will be covered by the operation of the Vessel. In addition, it can be expected that the Vessel will also be used in monitoring survey of artificial reefs and the surveys requested by external agencies regarding certain species or fishing. Thus, it will make it possible to achieve the target figure (campaigns at sea: 600 days per year) of the strategic Development Plan (2011-2013) of the INRH.

(2) Technical Aspect

The Vessel will make possible the advanced fisheries resource and marine eco-system surveys with survey equipment suitable for the survey and research level of INRH, and will have the ability to provide leadership in the field of studies and research on fisheries and the marine environment in Northwest Africa. To accomplish these policies’ objectives, the Vessel is designed to be able to take full advantage of the maritime zones of Morocco and neighboring countries being so far studied by foreign vessels for multidisciplinary studies and research, increased large scale, both in terms of area (including the Canaries Current Large Marine Ecosystem: CCLME) than the depth study (up to 1500 m depth). The implementation of the Vessel will collect scientific data more accurate and abundant on fishery resources, physical oceanography, biological oceanography and marine environments, as well

as boarding scientists than ever before, campaign and longer study in time and space. In addition, the new vessel stability improved will immeasurably reduce the constraints of study activities due to weather factors, and will ensure and enhance the safety of operations at sea.

On the other hand, for the two existing research vessels, the R/V « Charif Al Idrissi » and the R/V « Al Amir Moulay Abdallah » should be taken out of service respectively in 2020 and 2030 due to obsolescence. Therefore, if the Project would not be implemented, it would not be even possible to collect survey data as up to now, so as to make it impossible to develop and implement fishery resources management plans. The acquisition of the Vessel responds also to the need of an alternative vessel as soon as possible to replace the existing research vessels.

(3) Socio-economic Aspect

The economic benefits expected from an effective operation of the Vessel are: i) stabilization of catches (stable supply of fishery products), ii) development of deep sea shrimp resources, iii) processing and valorization of unexploited deepwater species iv) improvement of catch efficiency, and v) sustainable development of processing industry / improvement of the market value in the international market. In addition, on the social level, the Project will produce major benefits such as: i) early detection and reduction of marine pollution, ii) improvement of the educational level (increase of employment opportunities for researchers, increase of the number of students of science 2nd/3rd cycle of the marine environment), iii) stable supply of fishery products, and iv) contribution to regional and sub-regional cooperations.

Given the economic internal rate of return (EIRR) of the Project, we obtain a high value of more than 20% in all scenarios and all option plans. Even in the sensitivity analysis based on the assumption of a doubling compared to current fuel prices and profits only from catches of octopus and shrimp (as the worst case), gives an EIRR of 15.9%, where it is concluded that the Project is economically justified.

(4) Option plans

Taking into account the research capacities and functions required for the Vessel, the number of crews and researchers on board, and survey navigation plan, we designed two option plans, including: Plan A (about 1,100 ton) and Plan B (about 800 ton). In Plan A, where the construction cost is higher than Plan B and quantifiable economic benefits are identical, the EIRR is slightly lower. However, Plan A will have more autonomy (number of navigatable days), more people on board, and excels in the vessel's stability in comparison with Plan B. Because of these differences, Plan A will perform all the time joint survey with universities or neighboring countries, but Plan B opportunities to implement would be significantly limited. Given the fact that apart from the cost of construction and the cost of operation & maintenance between Plan A and Plan B (about 1.7 times), Plan A can adapt to a wider range of applications, it is recommended to opt for Plan A in which the Vessel provides a better cost performance over the long term.

10.2 Recommendation

Recommendations in the preparation phase and the implementation phase of this Project are listed in the following paragraphs.

(1) Promoting the implementation as a STEP Project

Considering the main characteristics and missions of the new vessel, the Moroccan side desires to construct the Vessel which satisfies the following conditions. It is necessary that the construction is performed in a shipyard having the experience in construction of "fishery research or training vessels" satisfying these conditions:

i) Have an International Gross Tonnage of more than 750 ton ;
ii) To be powered with a diesel engine during acoustic survey ;

iii) Have a level of underwater noise below the standards of ICES at a acoustic survey speed of 10 knots ;
iv) Upon cruise (at 85% power), having a noise level in the cabin meets the criteria set by IMO Res. A468 (VII). Having a vibration level in accordance with ISO 6954:2000 ;
v) To be equipped with a stern trawl with a slipway;
vi) To be equipped with double decks.

Over the past twenty years, a period beyond which the shipbuilding technology becomes obsolete and generally building experiences are no longer useful, Japan has experience of construction of five vessels in this area, while in other foreign countries, it is possible that only one vessel was built in 2012 for Namibia and fulfills all the conditions, but the details are not accurate (see table below).

Table 10-2 : Realized constructions of training and research vessels in Japan and in the foreign countries (the last 20 years, more than 750 tonnes)

	Vessel's name	Owner	Completion year	Overall length	Molded breadth	TJB	Site name	i	ii	iii	iv	v	vi
Japan	Soyo Maru	Fisheries Research Agency	28/10/1994	67.50	11.40	1,234	Mitsubishi Heavy Industries	●	●	●	●	●	●
	Wakataka Maru	Fisheries Research Agency	24/3/1995	57.73	11.00	990	Mitsui Engineering & Shipbuilding	●	●	●	●	●	●
	Shoyo Maru	Agence de la Pêche	12/5/1998	87.60	14.00	2,494	Nippon Kokan	●	× *2	●	●	×	●
	Kaïyo Maru	Tokyo University of Marine Sciences and Technology	30/6/2000	93.00	14.90	3,391	Mitsui Engineering & Shipbuilding	●	× *1	×	●	●	●
	Syunyo Maru	Fisheries Research Agency	27/4/2001	66.31	11.40	1,228	Niigata Shipbuilding & Repair, Inc.	●	●	●	●	●	●
	Hokko Maru	Fisheries Research Agency	31/8/2004	64.73	11.90	1,246	Niigata Shipbuilding & Repair, Inc.	●	●	●	●	●	●
	Koyo Maru	National Fisheries University	29/6/2007	87.59	13.60	2,703	Mitsubishi Heavy Industries	●	× *1	×	●	●	●
	Yoko Maru	Fisheries Research Agency	30/11/2010	58.60	11.00	991	Niigata Shipbuilding & Repair, Inc.	●	●	●	●	●	●
	Kagoshima Maru	Kagoshima University	30/3/2012	66.92	12.10	1,284	Niigata Shipbuilding & Repair, Inc.	●	×	×	●	●	●
	Oshoro Maru	Hokkaïdo University	2014 (Project)	78.00	13.00	2,000	Mitsui Engineering & Shipbuilding	●	×	●	●	●	×
France	THALASSA	IFREMER	1996	73.65	14.90	2,803	MancheIndustrie	●	×	-	●	×	●
United Kingdom	SCOTIA	FRS	1998	68.60	15.00	2,619	Ferguson Shipbuilders	●	×	●	●	●	●
	ENDEAVOUR	CEFAS	2003	73.92	15.80	2,983		●	×	●	●	×	●
USA	OSCAR DYSON	NOAA	2005	63.80	15.00	2,218	Halter Marine, Inc.	●	×	●	●	●	●
	HENRY B. BIGELOW		2006	63.80	15.00	2,218		●	×	●	●	●	●
	PISCES		2008	63.80	15.00	2,218		●	×	●	●	●	●
	BELL M.SHIMADA		2009	63.60	15.00	2,218		●	×	●	●	●	●
Norway	G.O.SARS	IMR	2003	77.50	16.40	3,800	Flekkefjord Slipp & Maskinfabrikk	●	×	●	●	●	●
Iceland	ARNI FRIDRIKSSON	MRI	2000	69.90	14.00	2,233	-	●	×	●	●	●	●

Ireland	CELTIC EXPLORER	Marine Institute	2002	65.50	15.00	2,425	Damen Shipyard	●	×	●	●	●	●
Spain	SARMIENTO DE GAMBOA	CSIC	2006	70.50	15.50	2,979	P. Freire	●	×	●	●	×	●
	MIGUEL OLIVER	Min M. Anb	2007	70.00	14.40	2,495	Montajes Cies SKL	●	×	●	●	●	●
	INTERMARES	Tragsa-tec	2009	79.20	15.00	2,954	Astilleros Armon	●	●	-	●	×	●
	RAMON MARGALEF	IEO	2011	46.70	10.50	988	Astilleros Armon	●	×	●	●	●	●
Namibia	MIRABILIS	MFMR	2012	62.40	14.00	2,131	STX Finland	●	●	-	●	●	●

Note / ● : Adapted condition × : Inappropriate condition － : ND
*1 / Diesel engine (single shaft with single engine) propulsion during navigation while by electric motor during survey.
*2 / Diesel engines (single shaft with two engines) propulsion during navigation while by electric motor during survey.

From the above matters, it is desirable, from a technical standpoint that the Vessel is built in a Japanese shipyard that already has a solid experience in construction of similar vessels. On the other hand, shipyards other than the Japanese ones have only limited experience in building vessels of diesel engine propulsion, so that it is difficult to be technically assured that these foreign shipyards can build the vessel without problem. In this context, the Moroccan government desires that the Vessel would be constructed in the Japanese shipyard that excels in techniques, so that it is appropriate to opt for the loan associated with Japan (STEP).

On the other hand, the cost comparison shows that the total project cost in case of the "General untied" is 200 – 220 millions Yen higher than STEP project. In addition, despite of almost same in terms of loan amount, the total amount of payment of the "General untied" project is approx. 710 – 850 million Yen higher than that of STEP, thanks to the difference of loan terms, nearly the same.

With respect to the foregoing, the advantage of implementing the Project within STEP loan is clear both technically and in terms of cost, it is recommended that the officials concerned spend maximum effort so that the Project can be implemented under this system.

(2) Efforts for securing necessary operation and maintenance cost

To operate, manage, and maintain the Vessel regularly, it is necessary that INRH stably obtain a budget for the expenses of management and maintenance (that will increase year after year). In addition, we currently expect a situation where the equipment and tools of less priority cannot be maintained sufficiently due to the lack of necessary budget. It is then desirable that the INRH take all necessary measures for the establishment of "maintenance funds" that it can use at its sole discretion, so as to further allow facilitating the operations and maintenance of research vessels in the one hand, and on the other hand working more quickly for creating and tackling on capacity development of the "Business Unit" whose concept is being developed by INRH (an independent operational unit that is to consolidate the functions provided today by the Supplies and Logistic Division of Department of Support in Research of INRH).

(3) Necessary Preparation for the Technical Assistance (T/A)

To ensure that the Vessel can start its survey navigation immediately after delivery to Morocco, it is important, during the construction phase, to develop the capacities of the Moroccan crew and scientific staff on board. The INRH should endeavor, through the DPM, to ensure according to the needs consultation and coordination with the JICA for the Yen-Loan attached Technical Assistance (T/A) may be initiated no later than one year before the date for delivery of the Vessel. In particular, it shall, before the commencement of any Technical Support, have skilled seafarers to board the vessel, train and monitor them through this Technical Assistance.